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EJNAR MUNKSGAARD · KØBENHAVN 1955-1961

H. C. RÜMKE

Problems in the Field of Neurosis and Psychotherapy

This book contains a series of five lectures held in Denmark (1950) and in the United States of America (November, 1951). The first lecture is a prelude in which the author attempts to reveal the frame of mind in which the lectures were conceived. The following points are at issue: The significance of the clinic in psychiatric investigation; the danger of systems; the replacing of the idea of causality by the idea of "conditions"; the principle of Hughlings Jackson; scope and limits of psychogenesis; dynamic and static interpretation in psychiatry; certainties and uncertainties in depth psychology. The author points out that neurosis is not a *morbus sui generis* but a syndrome. He tries to see how psychological and neurophysiological conditions are integrated. The significance of the conception of neurosis of the ascending and descending curve of life introduces the themes of lecture III (what factors determine an optimal psychic development) and lecture IV (phases of life and psychotherapy). In lecture V the author gives his opinion on what is changeable in the personality and what is not. At the end he describes some of the characteristics of the psychiatrist.

Of special interest to psychiatrists, psychologists, general practitioners, psychological and social workers.

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EJNAR MUNKSGAARD · COPENHAGEN

METHOD OF DETERMINING THE DISTRIBUTION OF ADMINISTERED HALOGEN IONS IN THE CENTRAL NERVOUS SYSTEM

By

SVEN-OLOF BRATTGÅRD and TORSTEN LINDQVIST

INTRODUCTION

Sensitive methods are needed for the study of the permeability and metabolism in small pieces of tissue or the separate cell. It must be possible to determine minute amounts of an administered substance, even when the tissue or cell originally contains the substance. At present there is no chemical method sensitive enough to determine halogen ions in the nuclei of the central nervous system. For this reason previous research into the distribution of halogens in the central nervous system has had to be carried out on the entire brain or spinal cord, or large parts thereof (14, 15, 18, 28). As for determining the amount of administered substance in a tissue, ordinary chemical methods cannot be used, only such using labelled atoms. The present article deals with a method for determining minute amounts of administered halogen ions in small regions of the central nervous system. The sources of error of the method and its reliability will be discussed. Radioactive isotopes are used. We have tested the method with ^{82}Br . However, as a chlorine isotope with a relatively long half-life, ^{36}Cl , is now available, it can also be used with this isotope. The method permits the determination of bromine in amounts of 10^{-9} to 10^{-10} g. in 0.01 mm^3 of tissue.

PRINCIPLE

Experimental animals are given radioactive halogen isotopes. After different periods of time they are killed and the brain and spinal cord removed. The regions to be examined are dissected out and frozen at once in carbon dioxide. The tissue is sectioned with a freezing microtome and the radioactivity in the sections measured immediately. The

amount of activity noted can be used as a relative measure of the amount of the administered substance in the specimen. Since the sections contain blood, and blood contains a large amount of active substance after the injection, corrections must be made for the activity of the blood as we want to know the activity in bloodless tissue. Two different methods were worked out to obviate this source of error. In some cases we removed the blood from the central nervous system by a perfusing process. In others we injected a "long-lived" radioactive isotope a few minutes before the animal was killed. This isotope had no time to penetrate into the nervous tissue before death ensued. Corrections could be made for the amount of activity of the blood in the sections.

DESCRIPTION OF METHOD

Cats weighing about 3 kg. were used. Two cc. of a physiological salt solution containing 0.05 g. of ammonium bromide per kg. of body weight were injected intraperitoneally. The ammonium bromide had an activity of about 0.2 mC. per kg. of body weight. Microscopical examination of nervous tissue showed that this dose caused no damage to the cellular structures. The bromide is rapidly taken up from the peritoneum (16, 26). This fact is verified (8). It was seen already in the preliminary studies that the bromine content did not rise as rapidly in the nervous tissue as in the blood, and not to the same level. In other words, a barrier is present. This being the case, at certain times after the injection the blood contains much larger amounts of radioactive substance than the nervous tissue. Since the aim of the present study was to determine the amount of halogen in bloodless tissue, it was necessary either to remove the blood or to subtract the amount of halogen present in the blood in the tissue. Some research workers (19) have made their animals bleed to death in order to obtain bloodless tissue. The anesthesia needed for this, however, changes the surface area of the capillaries in the central nervous system (9). Moreover, the central nervous system is never completely exsanguinated by methods of this type (17), which therefore are not suitable for our purposes.

We worked out a *perfusing method* for ridding the sections of blood. The animal is put to death with carbon monoxide. The monoxide dilates the vessels of the brain and prevents the blood from coagulating (14, 31, 33). Moreover, acute carbon monoxide poisoning leading to immediate death apparently does not injure the vessels (14, 31, 33). Immediately the animal has died a few drops of blood are taken from the aorta. The blood is weighed and the activity determined in two samples. A cannula is inserted into the aortic arch and the cranial part

of the circulation perfused with a physiological salt solution until the irrigating fluid becomes free of blood. To make sure that all the blood has been washed out, the salt solution is injected under a pressure twice that of blood and two or three liters of solution are injected. After perfusion the brain and spinal cord are removed and the required regions of tissue dissected out and frozen at once in carbon dioxide snow. The tissue is sliced into $100\ \mu$ thick sections with a freezing microtome. Two sections from each region are separately examined. The distribution of bromine may change rapidly from region to region in the central nervous system and so it is necessary to use small thin sections (6). As the microtome may slice sections of different thickness, the degree of this variation under the experimental conditions in question must be determined. In our experiments it proved to be ± 4 per cent (see under Discussion).

The sections were placed on aluminium dishes and the activity determined directly with a Geiger-Müller apparatus. We used an R.C.L. scaler and a T.G.C. tube with a mica window 28 mm. in diameter, weighing 1.8 mg. per square centimeter. The error of the apparatus varied between 1.2 and 3.2 per cent, depending upon the activity in the specimen under examination. All the specimens were placed at the same distance from the window. The absolute value for self-absorption was not calculated, as the same thickness of section was used throughout. The ± 4 per cent. variation in thickness caused a variation in self-absorption resulting in a measuring error of ± 3 per cent. After the activity was measured, the specimens were dried until a constant weight was obtained. All the weighing, except in the case of blood and cerebrospinal fluid, was done on dried specimens (7). The amount of dry substance in different regions of the central nervous system being known (see under Discussion), it was possible to calculate the water content of the specimens in question.

Two sources of error must be considered when the perfusing method is used. First, some blood may be left after the perfusion. Secondly, some of the bromine in the tissues may enter the salt solution during the perfusion. The size of the latter source of error can be calculated. Because bromide ions pass slowly through the blood-brain barrier, the error is insignificant (< 1 per cent) under the conditions in question, viz. perfusion for only five minutes and a relatively small amount of fluid. The significance of the first source of error, i.e. activity coming from blood left after the perfusion, can be seen from the following experiments. Pairs of animals of the same weight were subjected to the perfusing method seven hours after the injection of bromine (Fig. 1). As it was not possible to demonstrate any systematic

error, the random error was determined from the differences between the results of the parallel experiments. The random error for the separate determination amounted to ± 8 per cent. For the sake of comparison it may be mentioned that the random error noted on comparison of the results from the right and left side amounted to ± 10 per cent.



Fig. 1.

Comparison between activity from ^{82}Br in different regions of the central nervous system from two cats of similar weight. The relative activity is given in units of tissue fluid. One unit on the ordinate means about $0.15 \cdot 10^{-14}$ g. of bromine per g. of specimen, apart from self-absorption. The figure shows the activity seven hours after the intraperitoneal injection of 0.03 g. of ammonium bromide with ^{82}Br . The perfusing method was used. A = parietal cortex, B = spinal cord, C = medulla oblongata, D = pons, E = cortex of cerebellar hemisphere, F = hypothalamus,

G = white matter, H = caudate nucleus.

□ = 2.75 kg. cat

□ = 2.80 kg. cat

The other method used to eliminate the error caused by the activity in the blood consisted in determining the amount of blood in the section by means of radioactive phosphorus. We called this method the *subtracting method*. Two or three minutes before the animals were killed with carbon monoxide, an orthophosphate solution containing ^{32}P with an activity of 2–3 mC. per dose was injected intraperitoneally. The phosphate ions are rapidly absorbed from the abdominal cavity but they have not time enough to penetrate the blood-brain barrier during the short period elapsing before death (5, 16, 18, 19, 20, 32). After the animal dies, blood is taken from the aorta and the desired regions in the cerebrospinal system are removed and frozen in carbon

dioxide snow. The tissue is then sectioned in a freezing microtome in the manner previously described.

The combined activity from bromine and phosphate isotopes in the blood from the aorta and the sections is determined immediately in a Geiger-Müller counter. Ten to fourteen days later, the activity is measured again. As ^{82}Br has a half-life of 34 hours and ^{32}P one of 14.3 days, the activity recorded on the second occasion comes only from the phosphorus. It is then possible to calculate the phosphorus activity immediately after death, the relationship between the activity of bromine and phosphorus in the blood and also the bromine activity coming from the blood in the sections.

The following objections to the method may be made. First, as the blood-brain barrier is permeable to phosphate ions, a certain amount of phosphorus may penetrate into the tissue. Research has shown, however, that it takes more than ten minutes for measurable amounts of phosphorus to penetrate into the nervous tissue (5, 16, 32). Secondly, ^{32}P and ^{82}Br are differently distributed in the plasma and blood corpuscles (11, 24), and capillary and cardiac blood have different proportions of cells and plasma (13). This fact caused a systematic error which may amount to 4 per cent., but in the case of relative measurements it amounts at most to 1 per cent. (see under Discussion).

COMPARISON BETWEEN RIGHT AND LEFT SIDE

The exactitude of the method was tested by comparing the results from the right and left side of different animals. Several sections were taken from different regions of the central nervous system and the activity was measured in samples from both sides. The differences for each region were calculated separately.

When the perfusing method was used, the standard deviation of the difference (10) amounted to ± 14 per cent. Accordingly, the average random error of the separate determination amounted to ± 10 per cent.

When the subtracting method was used, the standard deviation was ± 17 per cent. and the average random error of the separate determination ± 11 per cent.

COMPARISON BETWEEN THE TWO METHODS

The systematic errors of the perfusing method tend to give too low values for the activity in the tissue and the subtracting method too high values. We calculated the difference between the two methods by

comparing the activity in animals treated according to the two methods one and seven hours after the injection of bromine. When the average activity shown after the perfusing method was taken as 1, the average values for the different regions after the subtracting method proved to be as follows:

Cortex of parietal lobe	0.9
White matter	1.0
Thalamus	1.0
Hypothalamus	1.1
Medulla oblongata	1.2

Accordingly, the systematic errors are not statistically significant, as they are of the same size as the random errors. It follows that both methods permit the determination of administered halogen ions with an accuracy of up to 15 per cent.

DISCUSSION OF SOURCES OF ERROR

Some of the sources of error were taken up in connection with the description of the method. We shall now discuss in more detail a number of factors and sources or error of great importance to the method.

Variation in thickness of sections.—It is impossible to measure the thickness of the sections optically because of the way they are to be treated later (5, 6). The variation in thickness was determined in the following manner. Small cylinders from different regions of the frozen brain were punched out on the sectioning table of the microtome. Each cylinder was cut into sections and two consecutive sections from each cylinder were weighed. Assuming that the two consecutive sections have the same specific gravity, the weight of each of them was also a measure of its thickness. The variation in weight between two consecutive sections proved to be ± 4 per cent. Naturally the magnitude of the error is highly dependent on whether the specimen is frozen or melting and on the temperature of the microtome when the sectioning is done. Consequently it is important that the person who does the sectioning should be trained in the freezing method. This was the case in our studies.

Variation in self-absorption.—When the measurements are made in Geiger tubes, consideration must be given to the thickness of the window of the tube, the distance between the specimen and window, and the amount of self-absorption. In our studies, all the specimens were placed at the same distance from the window and the same window was used for all the measurements. The amount of self-absorption occurring with different thickness of window can be calculated from Berne's tables (4). In fig. 9 the self-absorption, expressed as I/I_0 is given as a function of the sample's weight per unit of surface. I is the activity recorded and I_0 the activity that would have been recorded if there had been no self-absorption. The curves are for two thicknesses of window, 1.73 and 4.6 mg. per square centimeter. The window we used was 1.8 mg./cm.² thick. A variation in the thickness of the sample of ± 5 per cent. when the sample weights 50–80 mg./cm.² thus causes a difference of about ± 3 per cent. in the self-absorption. Since our study was mainly concerned with the relationship between different regions in

the central nervous system, the absolute self-absorption was not calculated for each case. The self-absorption is naturally greatly reduced by ashing the sample, but the drawback is that some of the bromine might evaporate when the temperature is raised high enough for ashing.

Amount of dry substance in different regions of the central nervous system.—

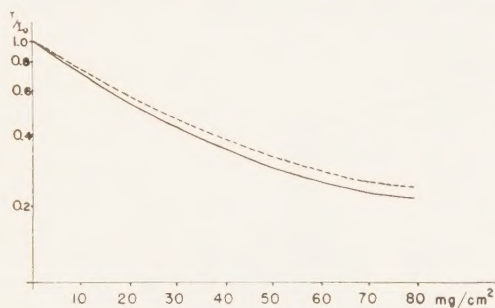


Fig. 2.

The influence of the thickness of the window in the Geiger-Müller tube on the self-absorption in specimens of nervous tissue of different thickness (from Berne's tables (4)). The measurements refer to ^{82}Br . I_0 = intensity of incoming rays, I = intensity of outgoing rays.

———— window thickness measuring 1.73 mg./cm.²
 ----- window thickness measuring 4.6 mg./cm.²

Different regions from the brain and spinal cord of six cats were dissected out. Small pieces were removed from them and weighed immediately. They were then dried at 105° C. until a constant weight was obtained. The study showed the following average percentages for dry in relation to wet weights for the different regions.

Cortex of parietal lobe	18 per cent.
Cerebellar hemispheres	22 — —
White matter	33 — —
Hypothalamus	29 — —
Thalamus	19 — —
Medulla oblongata	34 — —
Spinal cord	24 — —

Sources of error in the perfusing method caused by diffusion.—A circumstance which might distort the results when the perfusing method is used is that the bromine in the tissues may diffuse into the salt solution. The rapidity with which halogen ions spread through the capillary walls has often been demonstrated (16, 25, 26, 30, 38, 39). *Manery* and *Haege* (26), for example, observed that radioactive chlorine took only eight to ten minutes to spread into most organs. However, this was not true of the central nervous system. After forty-eight minutes it contained only 40 per cent. of the chlorine it would have if there had been no obstacle to diffusion. The blood-brain barrier delays the entry of halogen ions like chlorine and bromine (14, 16, 21, 26, 36, 38). *Amberson et al.* (2), studying the diffusion of

chlorine ions from different tissues into a chloride-free phosphate solution, noted that only 24 per cent. of the chlorine had passed through the blood-brain barrier after seven to eight hours of perfusion. If bromine behaves the same way as chlorine in the capillary wall (2, 12, 21, 22), it must take some time before the perfusion has a discernible effect on the concentration of bromine in the central nervous system. For this reason we kept up the perfusion for only five minutes. Naturally, even so some of the bromine must leave the tissue, but, judging from



Fig. 3.

Comparison between the results of two independent methods of determining tissue activity in different areas of the brain (see text). The activity was measured one hour after the intraperitoneal injection of ^{82}Br . Different regions of the central nervous system are given on the abscissa. A = parietal cortex, B = spinal cord, C = medulla oblongata, D = pons, E = thalamus, F = hypothalamus, G = white matter. The relative activity per unit of the tissue fluid is plotted on the ordinate.

See fig. 1 for the size of the unit.

□ = perfusing method

▨ = subtracting method.

what precedes (2, 16, 26), it must be less than one per cent. Five minutes is sufficient to flush the blood out of the vessels in the central nervous system. This is evident from a comparison with the other method (fig. 3) and from the fact that the irrigating fluid was free from blood when the perfusion was stopped.

Sources of error in the subtracting method caused by different proportions of bromine in blood cells and plasma.—The proportion between cells and plasma is not the same in the capillaries as in the large blood vessels (13). The amount of radioactive phosphate in the blood is determined in blood from the aorta, but in the sections the ^{32}P activity comes mainly from the capillary blood. Accordingly, consideration must be given to the question how bromine and phosphorus are distributed among blood corpuscles and plasma. *Van Dyke and Hastings* (11) mixed blood corpuscles and serum containing bromine and found that ten minutes later the bromine-chlorine quotient was 0.84 in the plasma and 0.66 in the blood corpuscles. Two hours later the quotients were 0.82 and 0.72, respectively. Since the amount of chlorine in the plasma is known to be 2.79 times that in the corpuscles (3), the bromine content in the plasma and corpuscles at the aforementioned times can be calculated. Phosphate taking longer to penetrate into the blood corpuscles than bromine, the blood corpuscles in our studies, i.e. after five

minutes, will contain an extremely small amount of marked phosphate ions. *Maizels* (24) demonstrated that if the permeability of blood cells to chlorine is taken as 1, their permeability to phosphate ions amounts to 0.15. After ten minutes, therefore, the phosphate ions in the plasma number 25.2 times the ones in the corpuscles. The proportion between blood corpuscles and plasma in blood vessels of different calibre has been thoroughly analyzed by *Fåhræus* (13). Using the hematocrit values given by him for vessels of different diameter, the relationship

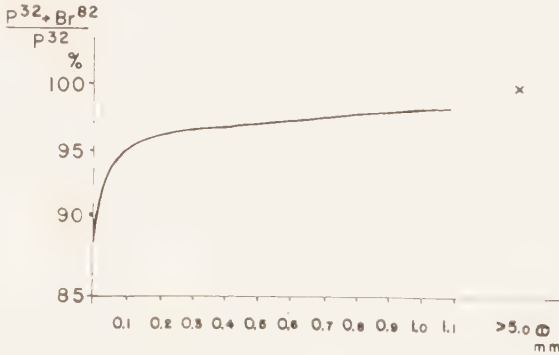


Fig. 4.

The influence of the blood corpuscles/plasma ratio on the quotient $\frac{^{32}\text{P} + ^{82}\text{Br}}{^{32}\text{P}}$ in blood vessels of different calibre.

$\frac{^{32}\text{P} + ^{82}\text{Br}}{^{32}\text{P}}$ can be expressed by the curve shown in fig. 4. As seen there, the error in question does not exceed 10 per cent. The size of the error is naturally dependent upon how the blood in the specimen is distributed among vessels of different diameter. If all the blood in one section of tissue were in vessels 1.0 mm. in diameter and all the blood in another section in vessels 0.05 mm. in diameter, the difference in the activity in the blood in these two extremes would only be 4 per cent. Since the blood in different sections of the central nervous system is contained in vessels of about the same diameter, the error caused by the difference in the calibre of the blood vessels when different regions of the central nervous system are compared will not exceed 1 per cent.

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DIFFERENCES IN EFFECTIVITY OF THE BLOOD-BRAIN BARRIER IN DIFFERENT PARTS OF CENTRAL NERVOUS SYSTEM

By

SVEN-OLOF BRATTGÅRD and TORSTEN LINDQVIST

INTRODUCTION

It has long been known that many substances dissolved in the blood take longer to penetrate into the tissue of the central nervous system than other tissues (2, 3, 25, 27, 33, 34). This is thought to be due to the existence of a blood-brain barrier. Many and extensive studies have been made on the physiological significance of this barrier, and likewise on its histological situation (see 13, 24 b, 42 for references). Several research workers have also investigated the question whether there is any difference in the way in which dyes penetrate through different parts of the blood-brain barrier (12, 13, 23, 24 b, 32, 41, 42). In what follows we shall present the results of our investigations, which show that the blood-brain barrier varies in effectivity in different parts of the central nervous system.

We have studied the manner in which bromine ions penetrate the blood-brain barrier, using a method previously described (9) for the determination of the distribution of bromine in the central nervous system with the radioactive isotope ^{82}Br . This method enables the determination and localization of small amounts of bromine. Bromine is highly suitable for a study of permeability. The bromine ion is relatively small, it is not organically bound (8), it occurs normally in the organism (30), it behaves like chlorine in the organism (28, 30, 36, 43, 44, 45, 46), and the bromine isotope ^{82}Br has a suitable half-life for the investigations. We have already discussed these advantages in greater detail (9, 8).

Most of the earlier research into the relation between bromine and chlorine in the central nervous system has been done in consideration of the conditions in chronic bromine intoxication (30, 36, 43, 44, 45).

For this reason it has been attempted to produce a steady state between the content of bromine in the blood and tissue by giving several doses of bromine over a comparatively long time. For a study of the permeability, however, it is much better to investigate the effect of a single dose.

METHOD

We used cats weighing 2.8 to 3.2 kg. as experimental animals. Each animal was given a single intraperitoneal injection of 0.05 g. of ammonium bromide containing ^{82}Br , dissolved in 2 cc. of physiological saline solution per 3 kg. of body weight. The radioactive activity amounted to about 0.7 mC. at the time of the injection. The animals were killed with carbon monoxide at different intervals after the injection. Since we were interested in the amount of bromine in bloodless tissue,



Fig. 1.

Comparison between results of two independent methods for determining tissue activity in different regions of the brain. The activity was measured one hour after the intraperitoneal injection of ^{82}Br . Different regions of the central nervous system are given on the abscissa. A - parietal cortex; B - medulla spinal; C - medulla oblongata; D - pons; E - thalamus; F - hypothalamus; G - white matter. The relative activity per unit of tissue fluid is plotted along the ordinate.

□ - perfusing method ▤ - subtracting method

measures were taken to prevent the results from being distorted by the bromine in the blood (9). In one series of investigations covering twenty-five animals, physiological salt solution was passed through the cranial portion of the animal's circulation for two to five minutes under a pressure twice that of the blood. The perfusion was kept up until the washing fluid was practically free from labelled isotope. The sources of error in this method have previously been discussed (9). In another series of investigations, covering nine cats, the animals were given an intraperitoneal orthophosphate injection, containing ^{32}P with an activity of 3 to 4 mC., two minutes before they were killed. Judging from previous research with this isotope, it would not have time to penetrate into the brain tissue during the short interval between the injection and death. ^{82}Br and ^{32}P having different half-lives, the activity of bromine and phosphorus in the blood can be calculated and subtraction made for the activity of the blood in the sections (see our previous

paper (9), where the sources of error of the method are also taken up). Figure 1 shows the results of the two methods for different regions of the brain one hour after the injection, when the blood content was highest and likewise the size of the error.

The different regions of the brain were dissected out macroscopically and cut into sections 100 μ thick. Tissue from both the right and left side was examined. The activity in the sections was measured in a Geiger-Müller apparatus (R.C.L. scaler with a T.G.C. tube) and corrected to apply to a given point of time. The amount of bromine in different regions of the brain could then be calculated in relative or absolute figures. As the absolute figures are more uncertain and of no significance to our point of enquiry, we calculated the activity in relative figures. After the preparations examined were dried in an exsiccator for six weeks at 105° C., they were weighed. The amount of dry substances in different regions of the central nervous system being known (9), it was then possible to calculate the water content of the specimens in question.

RESULTS

The amounts of bromine in different regions of the central nervous system are shown in Table 1. The results are based on about 2000 measurements. The activity is given as the ratio between the number of counts measured in the preparation and the number of counts the injected solution had per kg. of body weight. (An activity value of 1 corresponds to about $0.15 \cdot 10^{-14}$ g. of bromine per g. of preparation, self-absorption excluded).

We determined the activity and the dry weight. Usually the concentration of a substance is given per unit of dry or wet weight. Since it has been established that bromine occurs in the extracellular and intracellular fluid (8, 10), figures of this nature are misleading, in view of the different quantities of fluid in different parts of the central nervous system. For this reason we calculated the amount of bromine, i.e. the activity per unit of fluid. These figures are also given in Table 1. The concentration in the blood and cerebrospinal fluid are given per unit of wet weight in Table 2.

The results in Table 1 and 2 can be summarized as follows:

1. The blood soon acquires a large quantity of bromine, reaching its maximum in an hour.
2. The cerebrospinal fluid contains little bromine during the first few hours, but later on the content rises to a high level. The maximum is reached in seven hours. The content in the cerebrospinal fluid never exceeds that in the blood.
3. The parietal cortex, white matter, cortex of the cerebellar hemisphere, thalamus, medulla oblongata and spinal cord all attain their

TABLE 1

Time in minutes	Relative activity	Dry substance 10^{-4} Gm	Wet substance 10^{-4} Gm	Tissue fluid 10^{-4} Gm	Rel. activity Tissue fluid	Relative activity	Dry substance 10^{-4} Gm	Wet substance 10^{-4} Gm	Tissue fluid 10^{-4} Gm	Rel. activity Tissue fluid
<i>Parietal cortex</i>										
<i>White matter</i>										
60	659.1	79	439	360	1.83	264.4	73	219	146	1.81
180	1577.4	87	483	396	3.98	581.0	73	219	146	3.98
300	—	—	—	—	—	722.2	82	246	164	4.40
420	1930.0	68	378	310	6.23	1752.5	96	288	192	9.13
540	1256.9	55	306	251	5.01	882.2	45	135	90	8.02
780	1335.1	187	1039	852	1.57	545.6	110	330	220	2.48
<i>Cortex of cerebellar hemisphere</i>										
<i>Hypothalamus</i>										
60	340.7	27	123	96	3.54	246.1	38	131	93	2.65
180	1370.7	70	318	248	5.52	1103.9	37	128	91	12.13
300	1983.0	81	368	287	6.91	—	—	—	—	—
420	4357.6	87	395	308	14.15	2173.8	73	252	179	12.14
540	1574.2	44	200	156	10.09	—	—	—	—	—
780	1660.1	141	641	500	3.32	1500.0	107	369	262	5.72

<i>Medulla oblongata</i>			<i>Spinal cord</i>		
60	254.6	39	115	76	33.5
180	836.5	58	171	113	7.40
300	1173.7	78	229	151	7.77
420	1981.3	73	215	142	13.95
540	1260.4	57	168	111	11.40
780	1517.1	108	318	210	7.22
<i>Thalamus</i>					
60	330.7	36	189	153	2.16
180	789.4	53	279	226	3.49
300	1176.5	56	295	239	4.92
420	1784.7	67	353	286	6.24
540	—	—	—	—	—
780	1333.8	120	632	512	2.61

Relative activity in different "bloodless" regions of the central nervous system at different intervals after intraperitoneal injection of ^{82}Br . Relative activity is then calculated per unit of tissue fluid.

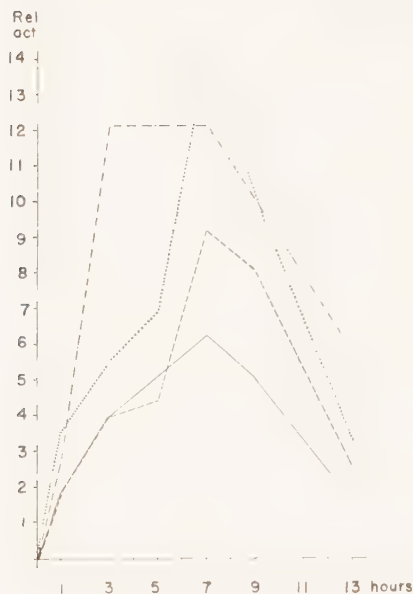


Fig. 2 a.

Relative activity per unit of the tissue fluid at different times after injection of ^{82}Br . This figure is a schematic representation of the results in Table 1.

—— parietal cortex, ----- white matter, - · - · - hypothalamus, cortex of cerebellar hemisphere.

maximum content in seven hours. The activity in the first two of these regions is of about the same order of magnitude, but only about half that of the last-mentioned region.

4. In contradistinction to the other regions of the brain examined, the hypothalamus reaches its peak activity in three hours. It is then about three times greater than in the parietal cortex.

These observations are also pictured in Figs. 2 and 3.

DISCUSSION

Weir (46) confirmed Nenckis' report (36) that bromine replaces equivalent amounts of chlorine in the body and that the quotient $\text{Br}/(\text{Cl} + \text{Br})$ is the same for all organs except the central nervous system, where it is lower. This was demonstrated by Wallace and Brodie (43, 44, 45). The question arises whether the differences in bromine activity are due to different amounts of chlorine in different regions. The methods for the determination of chlorine now on hand do not permit the determination of the small amounts of chlorine present in the regions examined in this study (1, 11, 24). Consequently it



Fig. 2 b.

Relative activity per unit of the tissue fluid at different times after injection of ^{82}Br . This figure is a schematic representation of the results in Table 1.

— thalamus, - - - - - medulla oblongata, spinal cord.

is not possible to make a direct comparison between the contents of chlorine and bromine. *Manery* and *Hastings* (34) found that grey matter contained 39.7 and white matter 36.5 m.Eq. chlorine per kg. of tissue. In another experiment they found that the chlorine in the cerebrum plus the medulla oblongata amounted to 46.5 m.Eq. and in the cerebellum to 46.7 m.Eq. These studies show only a small difference between different areas from the same animal. The difference is not large enough to explain the difference between the bromine activity in various regions of the central nervous system in our experiments.

The factors which determine the amount of a substance that can penetrate through a membrane, and which are of interest in this connection are the permeability of the membrane, surface area of the membrane, and the difference in concentration in the solutions on either side of the membrane (28). In protein solutions, e.g. plasma, the Donnan equilibrium must also be taken into consideration.

Accordingly, the amount of bromine (B) in the fluid phases of the central nervous system can be pictured as follows:

$$B = f \cdot \left(\frac{\text{permeability} \cdot \text{area}}{\text{volume}} \cdot k_1 \cdot c_1 \cdot t \right) \dots\dots\dots 1,$$

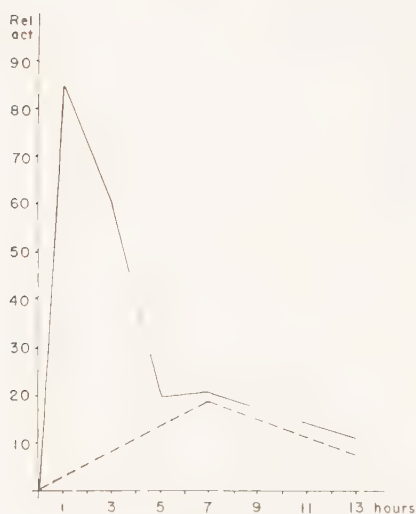


Fig. 1.

Relative activity per unit of weight of blood and cerebrospinal fluid at different times after the intraperitoneal injection of ^{82}Br . The figure is a schematic representation of the results in Table 2.

— blood, - - cerebrospinal fluid.

in which permeability is the permeability from the blood to the nervous tissue, i.e. a measure of the blood-brain barrier, area is the size of the vascular surface, k_1 the correction factor for the Donnan equilibrium, volume is the volume in which the activity is determined, c_1 the difference in concentration and t the time. The factor k_1 was calculated by *Hastings* and his coworkers (26) to be 0.95 for diffusible univalent ions on a comparison between plasma and its ultrafiltrate. However, the absolute figure for this factor is of no interest in this connection.

The concentration of bromine in different parts of the central nervous system depends on the permeability and the surface area of the vessels and difference in concentration in blood and tissue. The most important of these three factors are the permeability and surface area of the vessels.

Several studies have been made of the vascularity in different parts of the central nervous system (14, 15, 16, 17, 18, 19, 20, 21, 29), the degree of vascularity being generally expressed as the capillary length per cubic millimeter. *Campbell* (14) observed that the basal ganglia of the cat were less vascularized than the cortex of the cerebellum and the external geniculate body. He found that the globus pallidus was the least vascularized of the subcortical ganglia. *Finley* (21) discovered that with one exception the paraventricular and supra-optic nuclei had a denser capillary bed than any other nucleus in the brain stem and

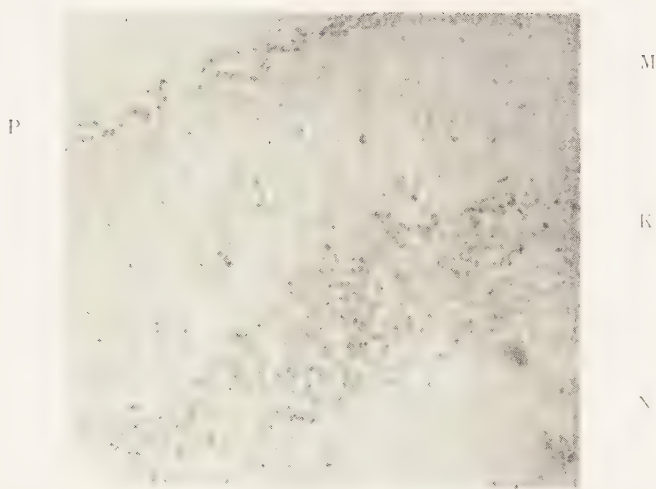


Fig. 4.

Autoradiogram of the activity referable to ^{82}Br in the cerebellum. The film was put on the unstained preparation. The area of powerful darkening (K) is over the granular layer. Compare the degree of darkening over the molecular layer (M) and the nerve fiber layer (N). The darkening in the left upper corner in the picture is caused by a pial vessel (P). $\times 350$.

cortical region. In another paper (20) he expressed the opinion that the density of the capillary network was generally proportionate to the number of ganglion cells. *Dunning* and *Wolff* (19) concluded from their studies that the blood supply was dependent on "the neural surface area", i.e. that regions containing many dendrites and terminal arborizations of axons were the most profusely vascularized. This observation was borne out by the investigations of *Hough* and *Wolff* (29). *Dunning* and *Wolff* (19), studying histological sections from cats, found that the total length of the blood vessels was 2.33 times greater in the cortex of the parietal lobe than in the underlying part of the centrum semiovale. According to *Craigie* (16) the corresponding quotient in frogs is 3.07.

On autoradiographic examination of the distribution of ^{82}Br in different layers of the cerebellar hemispheres, we (10) noted greater darkening over the cellular layers of the cortex than in the layer of nerve fibers, i.e. the white matter (Fig. 4). This observation is borne out by the quantitative figures for bromine in the cortical regions of the cerebellar hemispheres and white matter obtained in the present study. Comparison between the bromine contents in the two regions shows that the activity in the cerebellar cortex is twice as great as that in the white matter. The figure for the cortex must be a minimum

TABLE 2

Time in minutes	Relative activity	Blood weight 10^{-4} Gm	Rel. activity weight	Relative activity	Liquor weight 10^{-4} Gm	Rel. activity weight
<i>Blood</i>				<i>C.S.F.</i>		
60	25390.8	294	86.36	1756.8	490	3.59
180	2905.5	48	60.53	—	—	—
300	545.2	27	20.19	—	—	—
420	7457.2	331	22.53	6760.0	344	19.65
540	—	—	—	—	—	—
780	5661.1	513	11.04	6522.1	834	7.82

Relative activity in the blood and the cerebrospinal fluid after intraperitoneal injection of ^{82}Br . Activity recorded in relative values. Apart from self-absorption, one unit equals about $0.15 \cdot 10^{-14}$ Gm. ^{82}Br /Gm. blood or cerebrospinal fluid.

value, for some white matter is always attached to it when it is dissected out. If it is assumed that the vascularity is the same in the cerebellar cortex as in the cortex of the parietal lobe, the difference in activity between the cerebellar cortex and white matter could be fully explained by the difference in vascularity in the two regions. There is no need, therefore, to presume that the differences in activity are due to differences in permeability to bromine.

A study of our figures for the cortex of the parietal lobe and white matter shows that at first the bromine content was about the same in the two regions. Seven hours after the injection the white matter showed a slightly higher concentration than the cortex. The vascular surface in the cortex being 2.33 times greater than in the underlying centrum semiovale (19), this must have been due to differences in permeability to bromine in the two regions. Accordingly, the vessels of the white matter must be twice to three more permeable than those of the cortex of the parietal lobe.

On comparing the hypothalamus and other regions of the brain, it is only permissible to disregard the c_1 factor in formula 1 during the first few hours, since the concentration in the hypothalamus rapidly rises to a high level. Comparison between the hypothalamus and the parietal cortex reveals that at one and three hours the concentration was about three times higher in the hypothalamus. If the blood-brain barrier is the same in these two regions, this would indicate that the hypothalamus contains at least three times more blood vessels than the cortex. The high concentration in the hypothalamus may also have been caused by its being more permeable. It is not possible to prove this by the present investigations, though there is much to indi-

cate that its vessels are both more permeable and have a greater vascular surface area.

Lindberg (4, 31), *Bakay* (3, 4), and *Ernstler* (31) showed that ^{32}P injected into the subdural space rapidly penetrated into the brain tissue. This agrees with the results of other authors with solutions of other substances (50). There are a number of circumstances which indicate that substances in the cerebrospinal fluid penetrate into the tissue of the brain by way of the walls of the third ventricle. If this is so, the question arises whether the rapid rise in the activity in the hypothalamus could be due to the penetration of bromine from the cerebrospinal fluid as well as from the blood. As appears from Table 1, however, the concentration in the cerebrospinal fluid at the time of the highest concentration in the hypothalamus is so low that the bromine in the cerebrospinal fluid cannot explain the difference in activity in the different parts of the brain. It should also be noted that the activity in the cerebrospinal fluid continues to rise when the activity in the hypothalamus begins to decline. Furthermore, the thalamus lies close to the third and lateral ventricles, but the activity there takes another course than in the hypothalamus and is much weaker. Accordingly, it is obvious that the bromine which we measured in the brain tissue nearly all came from the blood. Only when measurements are made at long intervals after intravenous or intraperitoneal injection, can the activity in the cerebrospinal fluid have any mentionable influence on the results.

Most of the research into the permeability of the central nervous system has been done by injecting different dyes into the blood. *Goldman* (23) demonstrated that trypan blue penetrated through all the capillaries of the body except those in the central nervous system. His observation has been verified on the whole by others (12, 13, 22, 41). It has been learnt, however, that dyes of the benzidine type penetrate into certain limited areas of the system, thus, they have been found in the hypophysis (41), tuber cinerium (39), area postrema (48), epiphysis (32), paraphysis (38), optic recess (5), and certain regions in the medulla oblongata (41). *Behnson* (5) and *Gröntoft* (24 b) demonstrated how dyes penetrate in different ages.

It seems that only one study has been made on the permeability to salt of the blood-brain barrier in different parts of the brain. The rest of the research has been concerned with the blood-brain barrier as a whole (2, 37, 43, 44, 45, 46). *Hahn* and *Hevesy* (25) studied the manner in which sodium and potassium penetrated into the grey and white matter of the brain, but they do not say exactly what parts of the brain they examined.

Borell and *Örström* (6, 7) and *Reiss et al.* (40) showed that the epiphysis, hypophysis, and choroid plexus showed a greater amount of activity forty minutes after the injection of radioactive phosphorus (^{32}P) than other regions of the brain. They concluded that this was due to a greater turnover in these three regions. This conclusion is correct if the blood-brain barrier permits the phosphorus to penetrate to any degree into other regions of the central nervous system during this interval. Otherwise their observations indicate that the blood-brain barrier is of different nature in different places, and tally well with our results.

Wallace and *Brodie* (43, 44, 45) made a thorough study of the relationship between administered bromine and chlorine in different regions of the central nervous system. They calculated the bromine and chlorine values per unit of wet weight after the intravenous injection of one gram of sodium bromide. They found that the chlorine-bromine quotient was higher in the cortical regions than in regions containing white matter. The difference was greatest shortly after the injection and decreased gradually. It became even more apparent when the amounts of bromine and chlorine per unit of fluid was calculated. *Wallace* and *Brodie's* results and ours both point to the same fact, that it is more difficult for bromine to penetrate into the cortex than into the white matter.

SUMMARY

The authors have measured the radioactivity in different regions of the central nervous system at different times after the injection of a single dose of an ammonium bromide solution (^{82}Br) in a manner previously described. The activity was measured per unit of tissue fluid, as bromine is only present there. The activity proved to be the same in the cortex of the parietal lobe and white matter. It was greater in the cerebellar cortex, but reached its maximum there at the same time as in the first two, i.e. seven hours later. The activity in the hypothalamus reached its peak in three hours.

Different factors which might affect the activity in the tissue are discussed, e.g. the area of the vascular surface, the permeability and content in the cerebrospinal fluid. Some of the results could only be explained by different degrees of permeability in different regions, i.e. different degrees of effectivity in the blood-brain barrier.

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FOLLOW-UP STUDY OF SIXTEEN CHILDREN WHOSE MOTHERS WERE GIVEN ELECTRIC CONVULSIVE THERAPY DURING GESTATION

By

HANS FORSSMAN, M.D.

In 1938 *Cerletti* and *Bini* showed that an electric current could be used instead of drugs to provoke the generalized convulsions used to treat mental disease. Their method proved to have remarkable results and it was soon adopted all over the world. The past fifteen years have certainly done nothing to diminish its reputation. The indications for its use have become more clear-cut and the contra-indications have grown less and less in number. This is largely due to the fact that the method is now more routinely combined with the use of agents for relaxing the muscles and is consequently easier for the patient than it was in the early days of electric convulsive therapy.

At first physicians were loath to recommend electroshock for women who were pregnant. The general restraint in these cases appears from the literature, where articles concerning the electric convulsive treatment of pregnant women describe one, two, or three cases only; e.g. those of *Thorpe* (1942), *Pacella* (1944), *Leroux*, *Corman* and *Longuet* (1944), *Polatin* and *Hoch* (1945), *Kent* (1947) and *Simon* (1948). In 1946, however, *Bennett* and *Eagle* wrote in a general review: "We have successfully treated without incident to the pregnancy a number of women in all stages of pregnancy up to within 2 weeks of delivery." In 1948 *Boyd* and *Brown*, who also reviewed the literature on the subject, stated: "The health and maturation of the fetus do not appear to be influenced adversely by electroshock therapy, and no abnormalities in the delivered children have been recorded." The same opinion was expressed by *Williams* and *Barrera* in 1950. *Kalinowsky* and *Hoch*, finally, writing a monograph on electroshock treatment in 1952, gave as their opinion that pregnancy, even in late stages, was no

reason for not using convulsive therapy. They pointed out that many workers had used this form of treatment without the pregnancy being influenced in any way.

With the exception of *Thorpe* (1942) none of the above-mentioned authors made any follow-up study of the children in their cases. *Thorpe* examined the child seven months after birth and found it to be healthy. In all the rest of the cases the authors noted that the children were viable and healthy at birth but made no further check-up after they had left the delivery ward.

I was incited to make the present study by an article by *Yamamoto, Hammes and Hammes* (1953). They described a woman who was given electric convulsive treatment twelve times during her second pregnancy. A little more than three months after the last seizure she gave birth to a girl. It is not stated whether or not the delivery was complicated in any way. Nor is any information forthcoming as to the Rh immunity of the baby's parents. The mother is said to have been an "A" student at college. When the child was examined at the age of 32 months she proved to be greatly retarded mentally. She had been slow in sitting and was fifteen to eighteen months old before she could walk. She had not been toilet trained. All that she had learnt to say was "Mama". She was unable to carry out simple orders. The record also described her as aggressive and agitated, but neurological signs were absent.

Yamamoto and his coworkers pointed out expressly that they did not believe there was any connection between the treatment and the mental deficiency of the child.

This report was given a certain amount of attention in the medical literature. It was abstracted in both the *Journal of the American Medical Association* (1954) and *Nordisk Medicin* (1954). It is also pointed out in the abstracts that there is no reason to believe in a connection. However, the contra-indication suggested by *Yamamoto* and his coworkers is a serious one, if it exists. The very hint of it may prevent someone from getting this effective form of treatment. For this reason I thought it would be of interest to examine the sixteen children whose mothers had been given electric convulsive treatment during pregnancy at the clinic where I am working.

Naturally each hospital has only a few cases of this kind, but *Yamamoto's* article will probably give rise to other publications like the present one. It would be unfortunate if only the children who showed signs of mental deficiency were reported and so give a one-sided impression.

I shall not go into the case history of the mothers, this article being

only concerned with the children. If any of the children had proved to be feeble-minded, naturally it would have been interesting to know something of its mother's intellectual level. But such was not the case. In summary, it may be said that the mothers were all depressed, and one of them was also greatly confused.

Each of the mothers was asked about her child's psychomotor development, when it began to sit and talk, and so on. I then personally examined 14 of the 16 children and the two remaining children were examined by two other experienced physicians for geographical and other reasons. The judgment was based on the general impression of the development. No psychometric tests were used because in no case was there any doubt as to the child being fully normal. 14 of the 16 children were registered at child welfare bureaus, and in each case the opinion of the staff there was also acquired. The mothers were given electric convulsive treatment during the years 1947 to 1952. The children were examined during the month of August 1954. The essential information brought out by this study is seen in Table 1.

Only treatments taking a regular course are included in the table, none of abortive shock. As a rule not so many treatments were given as in the cases reported in the American literature. This is probably because our mothers suffered from less severe types of mental disorder. The last treatment was generally given at the end of the fourth month of pregnancy.

Accordingly, not one of the 16 children showed any sign pointing to mental deficiency. Even if one or two of the children had shown any such sign, there would still have been no reason to believe in a connection between it and the treatment. As it was, all the children were normally developed and in good health. In view of this and earlier experience, the isolated observation of *Yamamoto* and his coworkers is no reason why pregnant women should not continue to have recourse to electric convulsive therapy.

SUMMARY

Because of a report by *Yamamoto*, *Hammes* and *Hammes* on a case of mental deficiency in a child whose mother had been given electric convulsive therapy during the pregnancy in question, the author examined 16 children born after similar circumstances. All the children, the oldest of whom was 6 years and 9 months and the youngest 16 months old, were found to be normally developed mentally and in a good general condition. The author also gives a brief review of the literature on the treatment of pregnant women with electroshock

TABLE 1
Essential Data Concerning the Mothers and Children.

Child			Mother		
Age at examination	Examining physician's opinion	Opinion of child welfare bureau	Number of electroshock treatments	Week of pregnancy at last seizure	
6 yrs., 9 mos.	Normal development	Normal development	5	21st	
6 " 7 "	"	"	5	14th	
6 " 5 "	"	"	6	18th	
6 " 4 "	"	"	3	9th	
6 "	"	"	1	16th	
5 " 10 "	"	"	3	10th	
4 " 7 "	"	—	4	12th	
3 " 11 "	"	Normal development	3	11th	
3 " 9 "	"	"	5	11th	
3 " 2 "	"	"	4	16th	
3 " 1 mo.	"	"	6	16th	
2 " 7 mos.	"	"	2	12th	
2 " 5 "	"	—	5	11th	
2 " 3 "	"	Normal development	4	14th	
1 yr., 4 "	"	"	4	13th	
1 " 2 "	"	"	4	17th	

therapy. He is of the opinion that the isolated observation of *Yamamoto* and his coworkers should not stop pregnant women from having access to this form of treatment.

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A SOCIAL-PSYCHIATRIC EXAMINATION OF YOUNG FRONT-COMBATANTS

(Norwegian volunteers in the German army)

By

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Asker, Norway

(Reprinting prohibited except in medical papers)

When the German prisons and concentration-camps in Norway were opened on capitulation day, May 8th, 1945, and the severely tried Norwegians returned to liberty, after having experienced German justice in mind and body, a sad procession of other Norwegians started the opposite way. The prisons were filled by a mixed crowd of Quisling-supporters. Quisling's party, Nasjonal Samling (N.S.), had a total of 46,904 members on the 1st of January, 1945, corresponding to 1.66 % of the population. It was not necessary to arrest all these members. During the first months 24,000 men and women were taken into custody, and the Norwegian Administrations of Justice and Prisons were now presented with their greatest problem in our history. This work does not concern the solution of the problem. What is going to be recorded here is the author's experiences as a prison medical officer, during 3 years at Ilebu, the largest prison in Norway for traitors to the realm. Here the number of prisoners reached 3,453 in July 1945, falling slowly to about 1,000 in September 1946. The admission areas were Oslo and the surrounding counties, but the areas were not sharply defined. A central hospital with 120 beds for the whole country was attached to the prison.

INTRODUCTION. HISTORICAL SURVEY METHODS OF RESEARCH

It seemed obvious, even before the end of the war, that Norwegian psychiatrists would be partly responsible for the correct procedure of the trial, and also of a deeper understanding of the reasons why some of our compatriots failed. Because of the size of the problem one might

have feared that the trial would be summary and not in accordance with our democratic traditions. Immediately after the liberation we requested the authorities to ensure that the necessary psychiatric examinations were carried out just as thoroughly where the traitors to the realm were concerned, as in the case of other criminals in peace-time. There was no reason, however, for concern. As a matter of fact, all psychiatrists got so many of these cases that it was impossible to dispose of a sufficiently trained staff to carry out the main task we had planned: a psychiatric-psychological research of as many representative groups of traitors as possible.

On November 19th, 1945, the Royal Ministry of Law and Police appointed a committee, whose chairman was Dr. G. Langfeldt, which was charged with coordinating and directing the psychiatric examinations of traitors to the realm. What has been published so far is: *Olaug Bassøe*, Psykiatrisk undersøkelse av 50 kvinnelige landssvikere, *Nordisk Psykiatrisk Medlemsblad* 1948, vol. II, no. II. Ö. *Ödegaard*, A preliminary work on the frequency of insanity among N.S. Ö. *Ödegaard*, The incidence of mental disorder among the Norwegian Quislings, *Acta Psychiatrica et Neurologica, Supplementum* 47, 1947, and a preliminary work by *H. Frøshaug* on the examination of young front combatants: The Young "Patriots", *ibid.*

THE NATURE OF THE INFORMATION

It is difficult to divide the total information about the Ilebu prisoners according to the nature of their offence. The main difficulty is that when a prisoner has been proved guilty of more than one offence, it is not easy to point out his main crime. Nearly all have been members of Quisling's guard (originally a sort of bodyguard), many of them have great or small offences on their conscience, some of them have been partisans and also participated in one or many of the armed groups, etc. In the case material from Ilebu we find practically no torturers, as these were at first placed in solitary confinement in other prisons. The author has used the following loosely defined divisions:

- (1) Chiefly passive N.S. members with short terms of punishment.
- (2) Higher party employees, N.S. members in State and Municipality.
- (3) So-called "culture traitors", persons belonging to the free professions.
- (4) Auxiliaries in the rear (N.S. members attached to semimilitary organisations such as the Guard's alarm-unit, the Guard's industry council, the Guard's battalion).
- (5) Front combatants.

This publication deals with the 5th category only. We are concerned with young men, supposed to represent a positive selection, and whose offence often consisted in fighting on the German side at the Eastern front.

The front combatants have been sentenced according to the ordinary civil penal law of May 22nd, 1902, § 86, comp. temporary law of Oct. 3rd, 1941 on supplement to the same law, and temporary law of Dec. 15th, 1944 on supplement to the penal laws on treason (to the realm) § 51. These regulations penalise anybody who carries weapons illegally against Norway, or who assists the enemy in any way, either during a war in which Norway is involved or in order to prepare such war, or who weakens Norway or any allied country's fighting capacity. The sentences have varied somewhat, the tendency gradually being for milder sentences. In most of the front-combatant cases the sentences have been reduced to periods of 3-4 years' imprisonment.

HISTORICAL SURVEY

On Jan. 14th, 1941, an appeal dated on the 9th, and signed Vidkun Quisling, appeared in the Nazified Norwegian press. It encouraged young Norwegians voluntarily to enter the regiment Nordland, "in order to fight shoulder to shoulder with the German comrades for the new order in Europe, and for the German confederation." On the same day a statement was made as to the voluntary service. The Regiment Nordland was intended to be a regiment of the Waffen S.S., consisting of Scandinavians (excluding Swedes). Young men from 17 to 25 might apply, enlisting for 1, 2, or 4 years of service. Further, the appeal promised that if the volunteer "during his 2-years' service took active part in this war, he would get a document, conveying to him a farm with estates and 50 60 acres of good soil—". On Jan. 31st, 1941 it was officially announced that pupils for the matriculation classes of the secondary schools, applying to the Regiment Nordland, would get their certificates at once. In a decree of Febr. 23rd, 1941, by the Deputy Minister Riisnæs, the decrees concerning the regiment are gathered in 6 paragraphs. § 1 lays down that minors do not need consent from parents or guardians to serve in the regiment.

300 young men applied for admission to the "regiment". They were sent to the Eastern front and took part in the campaign, the whole time in the Waffen S.S.

It has not been possible to get exact information as to the number of young men who joined this and the above mentioned units. The author has got the figures by interviewing an active superior officer and several organisers of the front-service. They have been interviewed separately, and have given fairly similar information, and the figures are supposed to be approximately correct.

On June 22nd, 1941, Germany attacked the Soviet Union, on June 30th Terboven, the German High Commissioner of occupied Norway, proclaimed that he had been overrun by requests and solicitations from Norwegians, to be allowed to take part in the war. He had obtained permission from Adolf Hitler to have a Norwegian legion formed. The proclamation was followed by an appeal from certain officers, some representatives of trade and industry, some clergymen and exponents of nazi- and nazified organisations. It was stressed that the legion was to be ex-

clusively Norwegian, with Norwegian officers, Norwegian uniforms, and that they were going to fight only in Finland, now at war on the German side against the Soviet Union.

The so-called "Norwegian legion" was in action from July 1941 to May 1943. A total of 1200 men applied during this time. They were immediately sent to Germany, trained, and sent on to the Eastern front. None of them were first sent to Finland.

When they were being transferred to Germany an awkward situation arose, as some of the legionaries refused to take the usual soldier's oath to Adolf Hitler. The conflict ended in a compromise: the oath should only be valid as long as the war lasted.

During the whole service the legion was stationed in a "quiet" part of the front, that is a section where no attacks were made, either from the German or the Russian side. What the soldiers saw of the war was mostly Russian reconnaissance patrols, usually of a company or a battalion, and air attacks and shelling. Even so, it was a hard strain on the troops and the losses were considerable.

When the Norwegian legion was dissolved in May 1943, the so-called "Armoured Division Norway", was formed, as a section of the Division Nordland in the Waffen S.S. This was a German section, with a German commanding officer, and the Norwegian volunteers were mostly put together with people from Transylvania in Rumania. About 1000 Norwegian volunteers entered this section.

Already during the winter of 1941-42 the "ski companies" were formed, in order to fight in Finland. At the beginning of 1944 the force was increased to a battalion, partly by taking soldiers from the "armoured division". In this battalion there were 800 new volunteers.

Some volunteers from the Norwegian Police Force, the "police companies" were also sent to Finland. The first was formed in September 1942, and 4 companies with a total of 500 men were under fire.

It should be mentioned that during the war some Norwegian volunteers kept on applying for exclusively German work, in the air force, army and navy, estimated at 200 men.

In all, a total of 3,500-4,000 young Norwegians have fought in the German forces in the years 1940-45. Very few were sent to fight against the Allied Forces in West-end Europe—the great majority fought against the Russians. We have but little knowledge of what happened to them at the front. It is said that about 800 were killed, and that 100-200 returned with considerable, lasting invalidity. It seems certain that the legionaries were very dissatisfied at not being sent to Finland, and many of them tried to get home to Norway immediately after the transfer to Germany. Only a few cases of regular desertion are known. The state of health was good. There seems to have been few nervous reactions among the troops, but unfortunately there are no reliable data on this matter, as the case books from the clearing stations and base hospitals have not been available.

Many of the front combatants felt left out when they came back to Norway. The promised reward, the farm, failed to appear. Only a few of them entered party work, many attended schools, some of which were especially started for them, some got jobs in public offices. They still considered themselves soldiers and were apt to despise ordinary party members and civil administrators. A small group was still active-minded, and wanted to try armed resistance in May 1945 on the liberation. But the capitulation took place very peacefully and the front combatants did not offer any resistance when they were interned.

METHOD OF RESEARCH

The case material consists of 343 front combatants. They have been examined partly in Hebu prison, partly in the re-educational camp at Gulslogen, near Drammen. The author has tried to get statements from their schools, stressing the importance of not only obtaining the school results, but also an evaluation of the pupil and his home, from the teacher who knew him best. Fairly complete answers were obtained for 233 prisoners (67.9 %). Further we have questioned the staff of the prison, and the author has attended the meetings of the prison council, where the data of every front combatant have been discussed, in order to consider release on trial (after having served $\frac{2}{3}$, later $\frac{1}{3}$ of the term of punishment imposed). Without the prisoners being given any chance of contacting each other, they were requested to fill in a questionnaire, containing questions about social conditions, motives for the front service, their feelings about the imprisonment, the legal settlement and plans for the future. With the assistance of psychologists they have been tested, and we have had a psychological interview with most of them. Finally the author has had one or several conversations with every man. They have all had a careful physical examination.

Based on these data I have tried to get a correct picture of every single front combatant's social environment, social adjustment, and personal qualities, and tried to get an impression of his motives for applying for the front service.

In the work the author has been greatly helped by his assistant, Dr. Thorbjörn Kjölstad, and the psychologists Finn Høyland, Ragnar Christensen, and Ruth Kaminka Christensen. The investigations have met with interest and sympathy, both from the Superintendent of the prison itself, and from the Council of Prisons. We explained to the prisoners that this was not a disguised police examination, and that

TABLE 1
Age groups 1941.

	Total	Per cent
15 years	1	0.3
16-20 "	135	39.4
21-25 "	116	33.8
26-30 "	42	12.2
31-35 "	28	8.1
36-40 "	8	2.3
41-45 "	13	3.8
	343	99.9

the press would not be informed of the results, and after this they mostly accepted the tests willingly.

Most of the cases are young, 73.5 % 25 years old or younger in 1941, 8.1 % were less than 18 years old.

I. THE HOMES

TABLE 2
Father's occupation.

	Total	Per cent
(1) Agriculture, forestry, horticulture	55	16.0
(2) Cotters, rural workers	8	2.3
(3) Fishermen, whalers	3	0.9
(4) Craftsmen	39	11.3
(5) Independent business men, higher employees ...	44	12.8
(6) Engineers, architects	13	3.8
(7) Chief engineers, technicians	22	6.4
(8) Subordinate employees	39	11.3
(9) Captains, mates, sailors	9	2.9
(10) Industrial and plant workers	24	7.8
(11) Other workers	25	7.3
(12) Superiors in the Civil Service	8	2.3
(13) Subordinates in the Civil Service	7	2.0
(14) Teachers in Primary schools	6	1.7
(15) Intellectual work	12	3.5
(16) Workers in hotels and restaurants	4	1.2
(17) Pensioners	1	0.3
(18) Officers	11	3.2
(19) No answer	10	2.9
	343	99.9

The largest group of front combatants come from solid middle class homes. If we attempt to compare them with the average number of occupations or professions (from the census of 1930) we find considerably fewer from the farmer- and fishermen-class than would be expected. 43.6 % of the population belong to this group, as compared with 19.2 % of the fathers of the front combatants. 5.4 % of the population are sailors, as compared with 2.9 % here, 0.3 % are officers, as against 3.2 %. Summing up, it is safe to say that the front combatants do not socially represent a negative selection.

The divergent proportions of occupations or professions are certainly due to the fact that the admission areas of the prison mainly are Oslo and the neighbouring districts. An examination of the place of settlement of the front soldiers shows that 53 % come from Oslo and

the urban surroundings, 32 % come from the comparatively dense population of the Eastern districts, and the remaining 15 % are divided between Southern, Western and Northern Norway. 32 % were born in Oslo. There has been a considerable moving into Oslo of front combatants from the Eastern districts.

TABLE 3
Birthplace and place of settlement.

	Birthplace		Place of settlement	
	Number	Per cent	Number	Per cent
Greater Oslo	111	32.5	181	53.0
Akershus	32	9.4	30	8.7
Vestfold	26	7.6	20	5.8
Buskerud	25	7.2	27	7.8
Östfold	23	6.7	8	2.3
Telemark	16	4.7	13	3.8
Oppland	11	3.2	6	1.7
Hedmark	8	2.3	5	1.4
Gudbrandsdal	14	4.1	11	3.2
Österdal				
Sörlandet	13	3.8	9	2.6
Vestlandet	32	9.4	17	5.0
Trøndelag	12	3.5	8	2.5
Nord-Norge	10	2.9	5	1.4
Foreign countries	7	2.0	0	0
Not known	1	0.3	2	0.6

TABLE 4
Number of siblings.

	Total	Per cent
Only child	35	10.2
1 sibling	56	16.3
2 siblings	53	15.4
3 " 	51	14.9
4 " 	41	12.0
5 " 	27	7.9
6 " 	28	8.2
7 " 	21	6.1
8 " 	6	1.7
9 " 	10	2.9
10 " and more	11	3.2
No answer	4	1.2

According to this table the average number of siblings is 4.6. In the whole country the average number of children was 3.9 in the cities (in 1930) and 5.1 in the rural districts, based on 25 years' marriage. If we

exclude the childless marriages, however, the numbers are 5.2 in the cities and 6.1 in the rural districts.

As for the order of birth 47.2 % are in the middle, 30.8 % are the eldest child and 22 % the youngest.

Nervous handicap.

Insanity in near relatives (parents, siblings, grandparents, sibling of parents) is recorded in 27 cases: 7.9 %. Mental deficiency 3.5 %, epilepsy and psychopathy 3.2 %, alcoholism (father or mother) 6.7 %. All these data certainly represent the minimum. On this matter the author would refer to Dr. Ödegaard's paper.

TABLE 5
Special circumstances in the home.

	Total	Per cent
One or both parents died early or disappeared	76	22.1
Bad economy and insufficient care	46	13.4
Parents divorced	32	9.3
Reared by strangers	18	5.2
Upbringing remarkably strict	15	4.5
Illegitimate	11	3.2

Not all the homes in which one or more of the above-mentioned minus-factors are present, can be called bad. Considering all the cases it is found that more than half of the front combatants were brought up in homes which would generally be considered unsatisfactory. This is not due to economic difficulties only. During the first half of the thirties many Norwegian employees and workers had economic difficulties and unemployment for longer or shorter periods. We are still unable to qualify their homes as bad. In only 13.4 % of the homes with a very bad economy the care of the children was really insufficient. This includes homes with criminal parents, negligent housekeeping, disharmonious atmosphere, abuse of alcohol, and so on. Only to a certain extent were the children from these homes sent away to strangers or infant homes (5.2 %). The largest group had lost one or both parents early, or the parents had left home. Although this hampered the development of the children, it did not often disturb the family to such a degree that the Welfare of Children Council had to intervene.

If we consider the political influence on the youths, it appears that in 40.7 % of the cases parents or older siblings have been members of the "Nasjonal Samling" (N. S.). Further, we have all those with German-sympathizing families, deeply rooted in a dictatorial ideology, without being actually members of the N. S.

Summing up, we see that in only 21 % of the cases have the future front combatants been brought up in good homes in a safe atmosphere with kind relations between parents and children and among the children themselves, and without any Nazi influence.

II. THE SOCIAL ADJUSTMENT OF THE FRONT COMBATANTS

TABLE 6
Adjustment at school.

	Total	Per cent
Only primary school and 1 or 2 years' continuation classes	110	32.9
Secondary school, high school	82	23.9
Secondary school and commercial college	45	13.1
University — College — graduation	12	3.5
Vocational school (Commercial, technical, agricultural)	84	24.5

A preliminary examination of 208 unselected prisoners from Ilebu proved that 48.5 % had attended primary school only, as compared with 32.07 % of the front combatants. We have also had an opportunity to compare the education of the front combatants with that of ordinary Norwegian post-war recruits. In order to avoid the possible error of the difference of age (the recruits being 20–21 years old) we selected a group of front soldiers born in 1920 or later, thus being 19–23 when the service started, and presented a more detailed scale, with 9 different degrees of education.

1. Passed primary school.
2. Primary school and 1 years' continuation classes, 2 years' evening school, County school, Folk High School, 6 month's commercial school or other schools for young people, marine engineer's certificate of 3rd class.
3. Primary school and 2 years' continuation classes, school of agriculture, forestry, horticulture, Navigation school for ship's officers, marine engineer's certificate of 2nd class.
4. High School.
5. High School with 1 year commercial, agricultural, forestry, horticultural college.
6. Secondary or commercial college, 2 years' technical college, marine engineer's certificate of 1st class.
7. 1 year's study at university or technical high school, general preliminary examinations at universities.
Secondary school and commercial college, agriculture-forestry college.
8. At least 2 years' study at university or technical high school, teacher's training college.
9. Graduate from universities.

44 % of the front combatants have passed secondary school or higher education, as against 17.2 % of the recruits. In spite of the small figures, it seems justifiable to assume that the front soldiers

TABLE 7
Degrees of education of front combatants and recruits.

Degree	Front combatants born 1920 or later		Recruits 1946	
	Total	Per cent	Total	Per cent
1	41	30	25	0.4
2	18	13	3169	56.0
3	18	13	1495	26.4
4	24	17	160	2.9
5	14	10	276	4.9
6	19	14	315	5.6
7	3	2.3	208	3.7
8	1	0.7	6	0.1
9	0	0	0	0
	138		5750	

had had a better school education than the rest of the population of the same age.

The teachers recorded that the adjustment at school was fair in 50.2 % of the cases. Usual characteristics: Ordinary pupil, no objections, and so on. We notice that a good reputation was commoner than the opposite. Only 15.02 % were characterized as bad pupils, lazy, exceptional personalities, shirkers, poorly adjusted altogether. In 5.6 % special arrangements had been made, such as removal to reformatories or schools for the mentally handicapped. On the other hand 29.2 % were referred to by their teachers as unusually good pupils remembered by their teachers as having distinguished themselves by industry, maturity, and noble character.

Adjustment to work.

There is nothing to indicate that adjustment to work has not been generally good. 2.3 % of the front combatants have been exposed to long periods of unemployment. It must be kept in mind that although conditions towards the end of the thirties were improving, we had considerable unemployment until the first year of the war, varying in 1937 between 15 and 23 % of all trade union members. 2.6 % showed lack of stability in work and were constantly changing jobs. 2.9 % drank to excess and were fined once or several times for intoxication and disorderly conduct. 2.9 % show a slight degree of criminality with

short or probation penalties for theft, embezzlement, etc. In all 10.7 % of the case material show signs of maladjustment.

TABLE 8

Civilian professions or occupations of the front combatants.

	Total	Per cent
Subordinate employees in official and private work	72	21.6
Workers in agriculture and forestry	58	17.4
Industrial, factory workers	53	15.8
School-pupils, apprentices	45	13.5
Technicians, engineers	36	10.8
Independent tradesmen, higher employees	23	6.9
Craftsmen	15	4.5
Sailors	12	3.6
Intellectual work	9	2.7
Independent farmers, forest proprietors, horticulturists	7	2.1
Officers	4	1.2

The future front combatant's interests in political matters before the war, are illustrated by counting how many of them had been members of political organisations. 19.8 % had been members of political youth organisations, more than half of them Nazi ones (10.8 %), 5.2 % in conservative-influenced ones, 3.8 % in socialist-communist organisations, 6.7 % of the front combatants were not members of N. S. either before or during the war.

Sexual adjustment.

A remarkable number are, or have been married, 38 %. 13.7 % have been officially engaged to be married. The marriages have been unstable, 23.8 % did not last. Many were divorced during the stay in prison (not counted in). 2.3 % told that they were not interested in girls, the rest are supposed to have had a normal sex life, in so far as they have not shown any marked abnormalities. Only one showed a slight homosexual tendency.

Religious interests.

Most of the cases said they were indifferent, only 21 = 6.1 % took the trouble to answer this sort of question, and most of them only in order to declare their irreligiousness. 12 declared themselves to be bitter enemies of the Christian religion. They even considered resigning their membership of the State Church as a protest against its attitude during and after the war. 2 were Roman Catholic-influenced and as many as 7 had become devout Christians, partly after going through a religious crisis in prison.

III. PSYCHIATRIC-PSYCHOLOGICAL EXAMINATION

Intelligence tests.

The first tests were made by means of Dr. Sandven's group test, standardized on 876 pupils from the leaving classes of primary schools. It consists of 8 group tests with 20-30 single tests in each group. Of course a test standardized on 14 year-old-children is not ideal for adults, but undoubtedly it is still of some value. The result appears from the curves, on p. 455, indicating that the front combatants range within the average, 49.6 % with an I. Q. from 90-100.

In order to complete this research, we later on used two modern group tests. First a non-verbal test (test 10, progressive matrices, prepared by the English psychologist Raven) which, according to English experience, first tests the general intelligence. The test consists of 5 subtests, each with 12 tasks. The testee scores 1 point for each task correctly answered, the highest possible number of points being 60. The test is standardized on Norwegian post-war recruits. Next we used a mechanical test, which we included mainly in order to create goodwill, and if possible, to get data to work upon when selecting prisoners for special education. This test will not be further mentioned here.

In all we tested 646 prisoners with test no. 10, 319 of which were front combatants, 301 privates, and 18 officers. For comparison we also tested 17 men from an armed guard, the S.S.-Guard (see p. 454). In Table 9 is given the average age at the time of the tests, and the standard deviation for the following 3 groups: privates, front combatants with officer's rank, and the Guard.

Tables 9 and 10 show that with regard to age a comparison with the test results obtained from post-war recruits (average age 20 years) should be justifiable.

TABLE 9

	Average age	Standard deviation	Number of examined cases
Front combatants, privates	29.4	6.48	301
Front combatants, officers	33.9	10.45	18
The S.S.-Guard	28.0	7.05	17

The next table shows the division frequency in the different age groups of front combatants (privates).

Table 11 shows the results of the testing. The average result (M) of the scoring in points (1 point for each correct answer), and the distribution shown by the standard deviation σ are given. All M -values

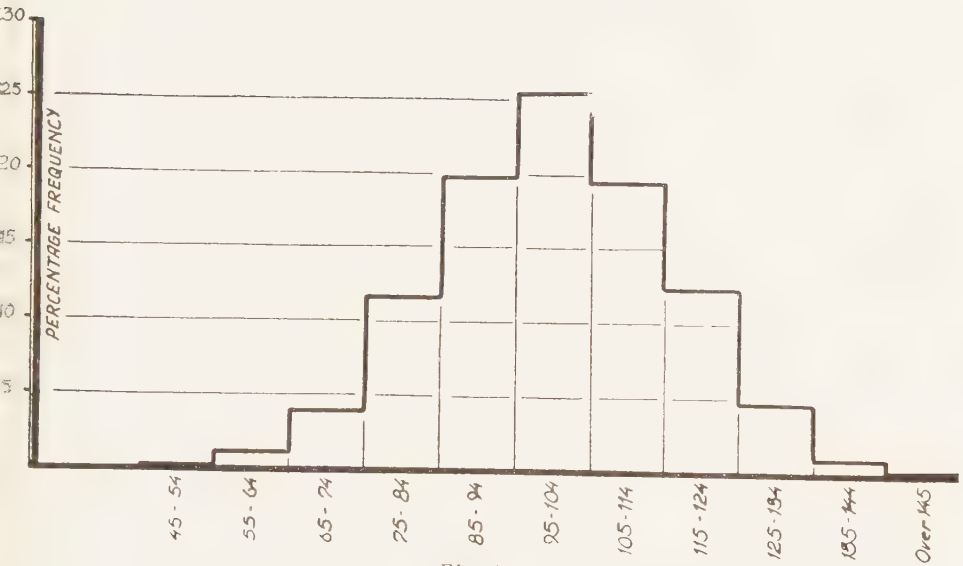


Fig. 1.

Distribution of I.Q. in Sandven's material. 876 persons tested.

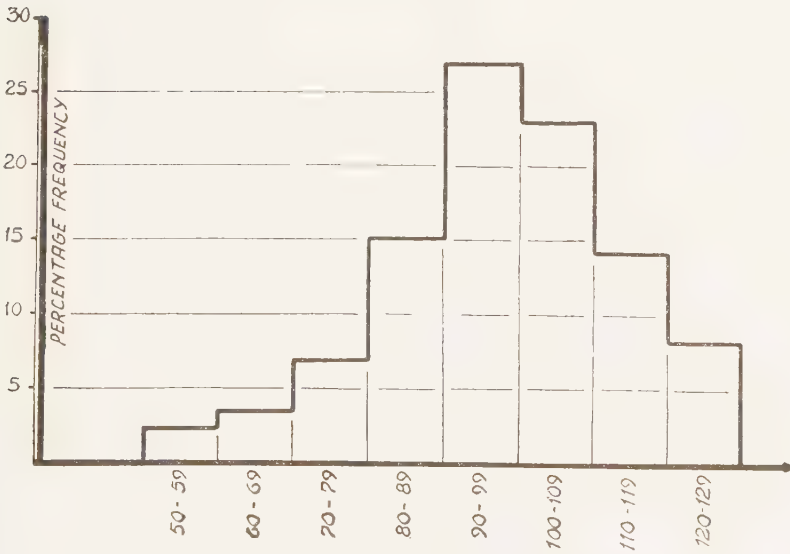


Fig. 2.

Distribution of I.Q. in 256 "front combatants."

TABLE 10
Division of age groups of front combatants (privates).

Age	18-20	21-23	24-26	27-29	30-32	33-35	36-38	39-41	42-44	45-47	48-50	51-53	54-56
No.	3	42	93	69	32	13	18	11	2	10	0	2	2

for the prisoners have been compared with the M-values of the post-war recruits. The difference, being in all groups in favour of the prisoners, are given in a special column. Apart from the results from the S.S.-Guard, all the differences are statistically significant.

TABLE 11
Category.

Category	M	σ	M-prisoners M-recruits	N
All prisoners	37.28 $\pm$ 0.35	8.95	5.10	646
Front combatants (privates)	38.11 $\pm$ 0.52	9.05	5.93	301
Front combatants (privates) born 1920 or later	38.41 $\pm$ 0.67	7.83	6.23	138
Front combatants (officers)	44.22 $\pm$ 1.40	5.15	12.04	18
S.S.-Guard	32.58 $\pm$ 2.75	11.35	0.40	17
Post-war recruits	32.18 $\pm$ 0.12	9.18	0	5750

The total average result for all prisoners is of modified interest and does not allow any definite conclusions as to the general intellectual level of the traitors. This is the case also of the officers and the S.S.-Guard—the groups are too small. We notice, however, that the test-results for the S.S.-Guard are significantly lower than for the other groups of prisoners. Concerning the front combatants tested, it seems correct to conclude that they offer a positive selection intellectually. We may object to the comparison with post-war recruits, that the front combatants (privates) are better educated, and can answer all sorts of tests more easily; further that they have been interested in doing their best in order to prove their superiority. Even so we think it justifiable to suppose a higher intelligence for the front combatants than for the average population of the same age. This is the reason why they wanted, and got, a better education.

The variation in intelligence is illustrated in Table 12, where the different performances are recorded. We have given the percentage division of each test-class of front combatants (privates) and of recruits. By using test-classes it is easier to classify the results than by

using rough-scores. We used a scale divided into 9. The test-classes 4, 5, and 6 are different degrees of average performances. The test-classes 7, 8, and 9 are respectively a little, more, and much more above the average, as the classes 1, 2, and 3 express performances below the normal.

TABLE 12
*Percentage distribution to test-classes for front combatants (privates)
and post-war recruits.*

Category	Cl. 1.	Cl. 2.	Cl. 3.	Cl. 4.	Cl. 5.	Cl. 6.	Cl. 7.	Cl. 8.	Cl. 9.
Front combatants (privates)	3.0	1.7	3.9	6.7	13.2	21.6	23.6	17.6	9.9
Front combatants (privates) born									
1920 or later	1.5	0.7	3.6	8.0	10.9	26.1	24.6	13.0	11.6
Post-war recruits	6.6	4.8	11.9	15.1	21.6	19.1	13.7	6.4	1.8

On the whole it seems justifiable to say that the intellectual equipment of the front combatants is somewhat above the average.

Personality types. The examination could not be as thorough as desirable, and it is difficult to give a reliable psychiatric diagnosis for each person. The great exceptions from the normal average, however, seem to be included, but the examination does not pretend to be an exact characterological analysis of the case material.

We have already mentioned the intelligence test. If we compare the test results with school-certificates and descriptions of behaviour, we find that 11 % must be classified as mentally handicapped. About 40 % of this category show social maladjustment, and most of them (76 %) had bad homes. The corresponding figures for the ordinary cases are 5.4 % and 40 %.

The individuals with exceptional personalities, without any mental deficiency, are of a greater interest, especially a small group of 10 typical sthenics (2.9 %), normally or highly gifted persons, oppositionists, energetic types with gifts of leadership and ability to form opinions, but without definite psycho-pathological features.

In 15 cases (4.4 %) we found distinct defects of character, without mental deficiency, 1 emotionally cold dysthymic, 2 distinctly insecure, restless neurotics, 1 post-concussion state, 1 with a tendency towards reactive depression, 4 schizoids, 1 idle, weak-willed alcoholic, 1 isolated dreamer and idealist, 2 weak neurotics, and finally 1 passive suggestible person with a tendency towards reactive depression. These 15 cases would generally be called psychopaths.

For several other front combatants distinctive psychic anomalies are found, such as slightly neurotic features, a tendency towards depression, slight schizothymia, hyperthymia, hypersensibility, but the features have not been dominating the personality or the behaviour of the person in a decisive way. 7 of them (4.6 %) must be characterized as distinctly schizothymics. They have all been treated in hospital during their stay in prison, mainly for anxiety-neurosis. 2 persons have suffered from a schizophrenic psychosis. When they were examined, they seemed to be without emotional reactions, but also without psychotic symptoms. 50 % of those with exceptional personalities come from bad homes and 25 % have been socially maladjusted.

A short summary concerning the distinctly exceptional characters is added here:

1. Born 1922: Cold, dysthymic, indifferent, taciturn, suicidal thoughts, brought up in an infant home, mother died when he was 4 years old. Secondary school, refused to be tested. Considerable abuse of alcohol. Motive: Wanted to help Finland.

2. Born 1917: Technical evening school. Neurotic, uncertain, restless, I.Q. 79. Poorly adjusted to work. Treated in hospital for neurosis. Motive: Craving for adventure.

3. Born 1914: Taint of insanity in the family, mother died early. Studied law. Matrice 49. Markedly weak character, neurotic. Motive: Sense of duty.

4. Born 1909: Severe, not understanding father, who died early. Secondary school. Unstable character, artistically gifted, subparanoid, substable, matrice 27 (too low). Motive: Enthusiasm for Finland.

5. Born 1924: From a Methodistic narrow-minded home, good adjustment at school, secondary school. Matrice 49, substable, supervalid. Motive: Craving for adventure.

6. Born 1912: Technical secondary school. Matrice 41. Stubborn, tendency towards reactive depression and explosions. Motive: Threatened by Chief of Police.

7. Born 1920: Happy family life, strong Nazi influence, ran away from religious environment. Matrice 40, I.Q. 95 (too low). Stubborn, difficult, schizoid, oppositional. Motive: Idealism.

8. Born 1921: Bad conditions at home, father received public aid, mother alcoholic, father died early. Lazy, not interested at school, refused testing. Passive, weak-willed, neurotic, depressed. Motive: Abuse of alcohol, influenced by environment.

9. Born 1920: Mother died early, stepmother. Matriculation; well adjusted, but not self-reliant. I.Q. 114. Absent-minded, dreamer, idealist. Very religious, poetically gifted. Motive: Idealism.

10. Born 1893: Mother epileptic. Officer. Neurotic, weak-willed, reactive depressions, poorly adjusted. Wanted to fight as an officer. Motive: Craving for success?

11. Born 1923: Happy home. Matriculation. Quarrelsome. Matrice 41, sthenic, schizoid, one-sided. Motive: Idealism.

12. Born 1922: Father given to drinking. Nazi. Dissenter school. Secondary school. Matrice 37. Schizoid, oppositional. Passing schizophreniform psychosis during the war. Motive: Craving for adventure.

13. Born 1923: Parents Nazi. Only primary school, bad marks in industry and order. Matrice 35. Suspicious, introvert, schizoid. Motive: Not known.

14. Born 1895: Happy family life. Non-commissioned officer. I.Q. 93. Lazy, alcoholic, weak-willed. Nervous period. Poor social adjustment. Motive: Influenced by N.S.-environment.

15. Born 1911: Tainted family. Father died early. Secondary school, good adjustment. I.Q. 100. Weak, superficial, suggestible, reactive depressions, poor social adjustment.

Summing up, three fourths of the cases have no exceptional features. They are emotionally rather stable, with normal strength of character, and they are well balanced. We also find that they have shown good social adjustment, and submitted to the stay in prison without losing their spiritual balance. It was not found necessary to differentiate the various normal types of personality, as might perhaps have been done.

Mental and physical health.

123 of the 343 cases, 35.8 %, were taken to the prison-hospital during the term of imprisonment. They were mainly treated for the common somatic diseases, and it would be going too far to include this matter here. Generally speaking, the state of health was good. 11 had moderate trouble after previous concussion of the brain, only one was taken to hospital with meningo-encephalopathia traumatica, 9 were invalids from the wounds they got during service at the front. According to case-books and out-patient records a total of 27 showed positive signs of nervous disease in prison. The trouble nearly always was reactive depressions caused by the internment, fear of the future, divorce, in one case a depression together with a critical change in his attitude towards spiritual values.

Summary of hospital-treated neuroses:

Born 19.5.20. In ward 19.12.46, appendicitis, and 24.2 26.2.47, neurosis. Stammering after scarlatina when 4 years old. In prison critical change in attitude towards life—conversion. Dreamer, writes long and vague poems, has visions without psychotic features.

Born 21.12.21. In ward 25.7.–5.8.1946, vegetative symptoms, slightly apprehensive, but well compensated.

Born 28.8.93. In ward during nearly the whole stay for debility. Neurasthenia, depressio mentis, Divorce-situation. Unusual character, slightly weak-willed, unsatisfied ambitions before the war.

Born 19.11.14. In ward 10.8.45 because of neurosis. Musician, neurosis from before the war. In ward vegetative symptoms. Rapid recovery. Probably war shock.

Born 19.7.22. In ward 18.4.–7.5.1947 and 12.6.–12.7.1947 and 11.10.–13.11.1948 be-

cause of neurosis. Always restless and unsettled, in prison anxiety neurosis with pronounced vegetative symptoms. Fairly well adjusted.

Born 11.2.1915. In ward 29.9. 2.10.1946 with gastritis chronica. Neurosis. Schizothymic, weeping, no severe neurotic symptoms.

Born 6.9.1917. In ward 8.7-29.7.1946. 1943 post-diphtheritic paresis. In prison anxiety neurosis with pronounced vegetative symptoms. Cured after careful examinations in hospital.

Born 13.10.1911. In ward 14.9. 2.10.1946 because of neurosis. Restless, depr. reaction to cell, solitary confinement. Subsolid.

Born 10.2.1906. In ward 24.11. 29.11.1946 because of neurosis. (Cor nervosum). Debility, reactive depression, anxious about family. Vegetative symptoms. Improvement.

Born 19.11.1922. In ward 3.9. 14.9.1946 because of psychosis ex const. Debility, fosterchild. Psychotic paroxysm with depression and slightly narrowed consciousness, -connected with religious crisis. Rapid improvement and later no adjustment difficulties.

Born 8.6.1917. In ward 23.5. 9.10.1947 because of hebephrenia. Psychiatric ward in 1939. Autistic, irrelevant laughter. Stereotyped, but no manifest process psychosis. In 1946, after judicial observation, not insane.

The total picture shows a predominance of healthy and industrious young men, only slightly affected by their participation in the war. Adjustment in prison caused practically no difficulties.

One of the prisoners has tried to express his reactions to the situation during the war in the following letter:

An immature boy of 17, heavily armed, really had very great power and authority in the army. When the fighting goes on, every soldier may do what he likes with the civilian population. He might kill or arrest any suspect person, and he might requisition all sorts of food and goods from anybody. The Russians were looked upon as "coloured people" in the same class as Indians and Arabs, and they were fought as if they were. As we know, the Soviet Union does not belong to the International Red Cross, and is governed in a despotic, half-Asiatic way, not shrinking from any means. The population belongs to a cultural standard considerably below the European average. Both parts disregarded the usual rules of the game. As compared with normal civilian life, front life is criminal, scandalous. Nothing counts, except to be safe and secure oneself. In order to survive we requisition the poor farmer's only pig, and occupy the houses, requisition furniture, conveyance, and food in a burnt and devastated town. During the fight we shoot what has to be shot, and more, otherwise we should have been killed ourselves. We steal the boots off the corpses and still, in normal life we are considered worthy citizens, but we do not feel split by this. The brutal morale of the war is, to a certain degree, acknowledged by international law, blessed by the Church and accepted by all nations who have ever been in war. We get cold and indifferent, we defend ourselves by getting brutal."

This letter is believed to represent the view of the group examined.

Motives.

This information ought to end in an adequate answer to the question: Why did these men join Hitler's armed forces? Some answers have already been given. The reason was not primarily mental debility and pathological characters. The author has tried to start discussions with the prisoners in order to make clear what was, according to their own words and explanations, their conception of their action and exploits. There are many possible sources of error. First, there is the risk that they will tell what might please the examiner, secondly, the prisoner wants to be loyal and faithful to the parole of giving only standard answers, reflecting the noblest motives, thirdly, he is of course the victim of a rationalizing tendency in himself, and lastly the examiner's possibility of evaluating the answers is limited. The author is under an impression, however, that the testees on the whole did their best to give correct answers.

TABLE 13
Personal motives.

Personal motives	Total	Per cent
A. Not dependent on political views	86	26
B. Political conviction	24	7.2
Fear of Russia, "the Communists"	59	17.8
Enthusiasm for Finland	51	15.3
Sense of duty, readiness to make a sacrifice	85	25.6
Victim to propaganda	27	8.1

Ad A: Every fourth front combatant in this information has stated their exploits were essentially due to circumstances, not depending on their attitude towards the political fight. Analysing the real motives, we often find (24 of the 86 (28 %)) that they wanted to travel and see something new and exciting. These were often weak, primitive types, easily influenced by casual acquaintances, without any political basis whatsoever. 13 (15.1 %) left for the front as a result of family conflicts, broken engagement, divorce. In 6 cases (7 %) it had been an escape-reaction, and the application for the front is to be considered as a neurotic solution of an unbearable problem. 13 (15 %) wanted to leave difficult conditions of work. Here we find, for instance, the workers in factories in Germany. When they applied for the front, they were promised a return home after 6 months' service, and then further training in Norway. One of them tried to escape when he was on leave in Norway, but was captured by the Germans, and got a long term of imprisonment. 4 (4.7 %) were in a desperate economic situation. Sur-

rounded by creditors, they preferred to go to the front. 5 (5.8 %) avoided prison by applying—a surprisingly small figure, because real enlisting took place in prison. 11 (12.8 %) said that they had been forced or fooled to enlist. Some of them were N. S.-members, who much against their wish had to join the armed forces. Some of them were mentally handicapped and did not understand what was happening to them before they found themselves in uniform.

TABLE 14
Not political motives.

	Total	Per cent
Craving for adventure	24	28.0
Bad economy	4	4.7
Family conflict	13	15.1
Bad working conditions	13	15.1
Escape imprisonment	5	5.8
Escape-reaction	6	7.0
Forced	11	12.8
Miscellaneous	10	11.5

Summing up, this group seems to show the most negative selection, with many mentally deficient and primitive cases, having in advance shown maladjustment. 36 % of the exceptional personalities wanted to go to the front from non-political motives, and to this group belong only 20 % of the characterologically normal cases. *Ad B:* It is most important, but very difficult, to divide the other main group, as the categories overlap. In the modest proportion of 7.2 % we count that a definite political opinion made them enter the fight actively. These are persons with a solid pre-war Nazi view of life. Even in this group, however, it was difficult to find a deeper comprehension of the real line of distinction between the two political ideologies during the war. They still kept all the postulates and catchwords of Nazi ideology, but none of them could, for instance, explain clearly in what way Hitler had infringed the usual West European principles of human rights.

The two next categories show more emotional motives. The fear of the Communists was often quite inadequately motivated, and they had swallowed downright lies. Speaking of Finland-enthusiasm we want to mention that 5.8 % of the total had already applied during the first winter-war, and they did not understand what should keep them from going on helping Finland. A very large group (25.6 %) had entered the war from a sense of duty. They were partly former N. S.-members, looking upon the front service as a natural consequence of their mem-

bership. Some of them were politically quite untrained people who wanted to do something for their country in this way. We find real idealists, led by their best principles. They had been much more strongly Nazi-influenced at home than the other groups. Many of the homes had been bad in other ways. Their intelligence is higher than the average, and their characters also represent a positive selection.

The last group is a mixed one: they had been led passively to front service without any personal opinion, sometimes because of emotional connection with a Nazi environment.

FINAL REMARKS. SOCIAL READJUSTMENT

To sum up the most important points of the information, one might say that the front combatants mostly consist of normally gifted, mentally and physically healthy individuals with good social adjustment. The reason for their tragedy is primarily to be found in their environment, which was often strongly Nazi-influenced and also insufficient in other ways—exposing these young persons more than usual to the unscrupulous propaganda.

Immediately after the liberation nearly all the front combatants willingly admitted that it had been necessary to intern them. As late as in the summer of 1946 nearly half of them (44 %), 176 examined prisoners, admitted that their foolish behaviour had to be punished, although they thought the punishment too severe, and they pretended to have been sincere. But in time their attitude has become more dis-obligng. The criticism of the sentences has become severer and in the autumn of 1947 they very rarely admitted any guilt at all. On the contrary—they now claimed rehabilitation, even those who first admitted not having had any political motives for their service in the German army. One might have feared that social adjustment would be difficult after the release. This did not seem to happen, however.

The author has sent a questionnaire to 88 released front combatants—31 have answered. They have all got work, only two had met trouble in their work. One says: "Released Oct. 14th, 1947. Started my own business the next day with a capital of kr. 30. Now employing 7 fellow prisoners."

The front combatants seem to have been socially well adjusted after their discharge. It appears that the large majority have returned to the community without any serious difficulties. Up to June 1954 only 19 of the 343 front combatants examined (6.2 %), have been brought to trial again for different offences. These have been committed during the years 1947–54, and do not seem to be connected with special circum-

stances in relation to the release. Only 3 cases are serious ones (robbery, sexual offence) the rest are of a trifling nature, petty thefts, minor offences against the traffic regulations, etc.

In 3 cases the offenders have been influenced by their former political activities (help to escape from prison camps).

6 of these 19 offenders come from good homes and were previously well adjusted. The remaining 13 have exceptional personalities, 7 of them are mentally deficient, 3 were delinquents before the war.

SUMMARY

The material consists of 343 front combatants. The investigation was carried out at Ilebu Prison (the main post-war prison of Norway for traitors to the realm). 73.5 % of the cases presented were 25 years or younger in 1941, 8.1 % were less than 18 years old.

The largest group come from solid middle class homes, 53 % come from Oslo and the urban surroundings, 32 % come from the comparatively dense population of the Eastern districts, and 15 % from Southern, Western and Northern Norway. More than 50 % were brought up in homes which would be considered as unsatisfactory. In 40.7 % of the cases parents or older siblings were members of "Nasjonal Samling" (N. S.). Only 21 % of the cases were brought up in good homes, with satisfactory relations between the members, and without any Nazi influence. 44 % of the front combatants have passed through the secondary school or higher education. It seems justified to assume that the front soldiers had better school education than the rest of the population of the same age. The adjustment to work has been generally good. Only 10.7 % of the cases show signs of maladjustment, 19.8 % have been members of political youth organisations, more than half of them Nazi ones. 6.7 % of the front combatants have never been members of N.S. 38 % have been married, 23.8 % of the marriages ended in divorce. None of them showed any marked sexual abnormalities. Most of the cases were indifferent as regards religious interests. The front combatants offer a positive selection intellectually, with an intellectual equipment somewhat above the average, 11 % must be qualified as mentally handicapped, 4.4 % show distinct defects of character, without mental deficiency. Three fourths of the cases showed no exceptional features, 35.8 % were treated for usual somatic diseases during the term of punishment, 27 cases (7.8 %) showed positive signs of nervous disease, 26 % joined the Nazi army from personal motives independent of political view (such as family-conflicts, economic difficulties, etc.). This group seems to show the most negative

selection. 7.2 % joined the army because of their political opinion. 25.6 % entered the war from a sense of duty. The front combatants seem to have been socially well adjusted after their discharge. Only 19 (6.2 %) have been brought to trial again, and their offences are minor ones. The rest appears to have returned to the community without any serious difficulties.

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SCLEROSE TUBEREUSE REVELEE PAR UN ETAT DE MAL EPILEPTIQUE AU NEUVIEME JOUR D'UNE VACCINATION ANTIVARIOLIQUE CHEZ UN NOURRISSON¹

Par

G. HELDERWEIRT
(Anvers)

L'observation suivante nous paraît assez intéressante pour être communiquée in extenso, malgré que la préexistence d'une grave maladie malformative des centres nerveux rende l'appréciation du mécanisme physiopathologique de la mort quasi insoluble.

Elle montre cependant que c'est avec une certaine réserve qu'il convient d'accueillir les observations d'encéphalite vaccinale mortelle chez l'enfant de moins d'un an.

Boey ... Hild ..., née le 23.9.1950.

C'est la 5e d'une famille de 5 enfants: les quatre autres sont bien portants et n'ont jamais présenté de convulsions. Poids à la naissance: 4,200 K. Elle n'a fait aucune maladie. Développement normal: premières dents à 6 mois; elle faisait ses premiers pas.

Le seul fait à signaler au cours des cinq dernières semaines c'est qu'il arrivait que pendant le jour et même la nuit l'enfant prenait la tête entre les mains comme si elle avait mal de tête.

Vaccination antivariolique le 11.10.1951 (Vaccin de l'Office Vaccinogène), vaccination organisée par la commune: les 16 autres enfants vaccinés n'ont présenté aucune réaction anormale.

La nuit du 18 au 19.10 l'enfant avait en un sommeil agité mais dans la matinée du 19.10 elle avait joué normalement.

Le 19.10 à 2 heures de l'après, midi, *brusquement*, vomissements – convulsions et coma. Le médecin injecte du luminal (5 cgr); comme l'état ne change pas il envoie l'enfant à la clinique le soir.

A 11h. ½ du soir: toujours coma complet; respiration stertoreuse: convulsions intéressant tout le côté gauche: face, bras et jambe; paralysie flasque du bras droit et de la jambe droite avec abolition des réflexes. Pas de Kernig, pas de raideur de la nuque; réflexes pupillaires faibles à droite et à gauche. Par ailleurs examen négatif: coeur, poumons, foie, rate, gorge, oreilles, tympans: normaux.

¹ Travail du Laboratoire de Neuropathologie de l'Institut *Bunge*.

Sur l'épaule gauche il y a une pustule vaccinale recouverte d'une petite croûte et présentant un aspect tout à fait normal pour le 9^e jour.

La ponction lombaire donne une pression augmentée, un liquide clair contenant 0,11 d'alumine, 1,10, de glucose; 0,2 lymphocytes par mm³.

Traitement: luminal, oxygène, tonicardiaques.

Evolution: décès à 3 heures du matin, sans être sortie du coma.

En résumé: au 9^e jour de la vaccination antivariolique, coma brusque et décès 13 h. plus tard, chez une enfant de 13 mois.

Autopsie: 14 h. après la mort: forte congestion des vaisseaux cérébraux – dans les lobes temporaux et le lobe frontal droit on palpaît des nodules indurés.

Etude histopathologique (I.B. 79/51).

Sur blocs inclus à la celloïdine, coloration de Woelcke-Heidenhain et crésyl-violet. Coupes à congélation: crésylviolet et rouge écarlate.

Voici le protocole du Dr. Ludo van Bogaert.

La topographie du processus pathologique est aisée à suivre sur les grandes coupes myéliniques. Le premier grand bloc vertico-transversal intéresse le plein développement des noyaux gris centraux et passe par le plan du noyau rouge et du corps de Luys. Une zone grisâtre et agyrique occupe le gyrus cinguli, la partie de F1 qui borde la scissure interhémisphérique, tout le dôme de F2, et descend en îlots qui suivent les trajets périvasculaires jusqu'à l'entrée de la capsule interne. A ce niveau on voit encore une petite zone grisâtre, dorsalement du noyau caudé.

Il y en a deux autres dans l'avant-mur, mais les noyaux gris centraux paraissent, à cet agrandissement, intacts.

Au niveau de la circonvolution temporale supérieure, le boursofflement du dôme de la moitié de la circonvolution commence au niveau de la scissure de Sylvius et tout le dôme de T1 est éclairci. T2 est intact mais autour de la corne inférieure du ventricule latéral il y a encore plusieurs plages grisâtres. Fig. 1.

Toute la circonvolution temporale inférieure et la circonvolution fusiforme sont couvertes par un zone grisâtre amyélinisée. On reconnaît en dedans la partie dorsale de la circonvolution de l'hippocampe et l'uncus.

Un second bloc (fig. 2) passant par les circonvolutions occipitales montre que l'axe blanc du précoin et de la circonvolution fusiforme et linguale est le siège de petits foyers "en coups de pinceau". Il en est de même dans l'axe blanc du gyrus cinguli, du précoin et même du lobule paracentral. Ils rappellent des plaques de sclérose. Par contre une vaste zone grisâtre efface toutes les structures myéliniques à partir de la circonvolution pariétale jusqu'au niveau de la circonvolution temporale inférieure, entreprenant ainsi le lobule pariétal, le pli courbe, et la partie caudale des trois circonvolutions temporales dans leur partie postérieure et boursoffle toute la zone supéroexterne de la convexité. Le centre de ces zones paraît légèrement spongieux. Quand on y regarde de plus près on voit aussitôt que le dôme de la pariétale postérieure est lui aussi éclairci.

Les coupes myéliniques intéressant le cervelet, le tronc cérébral et le bulbe ne montrent rien de particulier.

Les images histologiques sont au point de vue de la topographie des lésions superposables aux images myéliniques que nous venons de décrire mais l'extension des lésions est ici plus considérable.

Les noyaux gris centraux ont une structure normalement conservée. On remarque seulement une gliose un peu plus dense qu'à cet âge dans le noyau ventro-médian de la couche optique et le pallidum.

Le locus niger, le tronc cérébral, le bulbe ont leur aspect habituel.

Le cervelet montre une persistance de la couche granuleuse extrême, persistance irrégulière ne s'observant d'une manière nette qu'au niveau de certaines lamelles.



Fig. 1.

Cette couche paraît doublée ou triplée par endroits. La leptoméninge piale montre une infiltration modérée avec une stase vasculaire importante. Le noyau dentelé présente au niveau de son hile la même stase veineuse. Un certain nombre de cellules dans le hile et l'écorce ont un aspect lavé, rappelant les lésions homogénéisantes.

Au point de vue de la *structure du processus pathologique* on doit retenir les faits suivants.

Les zones pâles dans le télencéphale correspondent en réalité à de larges secteurs de malformations corticales et souscorticales: on trouve dans l'écorce des cellules ganglionnaires de forme épineuse, à direction inversée; d'autres, énormes, rappelant les cellules de Betz; des cellules fusiformes sous-piales et, juxtaposées à ces éléments neuronaux, de grandes cellules gliales à protoplasme vitreux, rappelant la macroglie engraisée, parfois à deux noyaux et ayant tendance à se grouper en petits amas. Dans l'axe blanc, le long des vaisseaux on retrouve les mêmes petits amas de grands éléments gliaux parfois intriqués les uns dans les autres.

Les mêmes atypies cellulaires se voient dans la couche optique, le pallidum, le noyau dentelé et les noyaux de la protubérance.

Les aspects « chromatophobes » des éléments de Purkinjé et d'un certain nombre de cellules dans le noyau dentelé ne sont rien d'autre que l'expression du trouble circulatoire fonctionnel qui a accompagné l'état épileptique et ont la valeur des lésions homogénéisantes de Spielmeyer.

Nulle part on ne parvient à mettre en évidence dans le névraxe des lésions permettant d'affirmer l'existence d'une encéphalite vaccinale.



Fig. 2.

La signification de ce cas est particulière sous deux angles :

1° Une sclérose tubéreuse importante par ses lésions cérébrales tout à fait muettes au point de vue psychiatrique, neurologique et cutané, survenant dans une famille saine, peut donc demeurer latente pendant des mois et on comprend que dans de tels cas elle puisse être méconnue si l'on n'a pas l'attention attirée sur ses caractères macro- et microscopiques.

2° Elle se révèle cliniquement dans le cas que voici à l'occasion d'une vaccination – exactement huit jours après celle-ci (c.à.d. dans le délai de l'encéphalite vaccinale classique) – par un état de mal épileptique avec coma et vomissements dont l'enfant n'est plus sortie.

A ce double titre nous avons jugé utile de le faire connaître.

MENINGIOMAS OF THE THIRD VENTRICLE IN CHILDREN

*Review of the Literature and Report of two Cases with Uneventful
Recovery after Surgery*

By

F. HEPPNER, M.D., F.I.C.S.

It is well-known that meningiomas are generally rare in infants and children. Table 1 gives a survey of the larger series of brain tumors in children with the respective number and percentage of those which are meningiomas.

Intraventricular meningiomas have been described but are also very rare. In most cases they are found to occur in the lateral ventricles originating mainly from the choroid plexus and only exceptionally arising from the tela choroidea superior. Of this latter variety *Cushing* and *Eisenhardt* (7) have summarised 20 cases.

Meningiomas originating from the dorsal part of the tela choroidea superior seem to occur with extreme rarity and have been reported in 4 cases. *Cushing* and *Eisenhardt* (7) could not observe a single case mentioning only 2 cases of *Bailey* and 1 of *Horrox*. In 1937 *Araki* (1) reported on the 2 cases of *Bailey's* in detail. Recently *Glass* and *Abbott* (11) described the nearly simultaneous occurrence of intracranial tumors in two sisters. In one they found a meningioma in the third ventricle accompanied by multiple meningiomas and by cutaneous and central manifestations of von Recklinghausen's disease.

Dandy (8) in his series of benign tumors of the third ventricle mentions no such tumor. *Zülch* (21) points out its occurrence without describing any case of his own. Recently *Miller*, *Craig* and *Kernohan* (18) reported on 518 brain tumors in children. 190 of these were supratentorial, including 12 meningiomas only, none of which occurred at the above-mentioned site. *Tönnis* (19) in his material of more than 3000 brain tumors observed no meningioma in the third ventricle.

TABLE 1
Brain Tumors in Children.

	Total	Meningiomas	%
Arendt, Kornyansky (2)	600	25	4.1
Craigh, Keith, Kernohan (4)	427	11	2.6
Cushing (6)	154	2	1.3
Zülch (20)	263	9	3.4
Foerster (9)	101	3	2.9
Bailey, Buchanan, Bucy (3)	100	8	8
Gaspero (10)	100	2	2
Cuneo, Rand (5)	83	2	2.5
Kyrle (15)	67	1	1.5

Kornyansky's report (14) on 600 infantile intracranial tumors includes 26 meningiomas (4.3 %) but none within the third ventricle.

3 cases of *Olivecrona's* are known to the author (13) and 2 have been operated upon in this department. Reporting these last cases seems to be worth while since, besides arising in this rare location, they occurred in childhood.

CASE REPORT

Case 1.

F. W., admittance number 2529/51, was an eight year old boy. Born as the first child of a mentally defective mother, his weight at term was 4 kg. Three months prior to admission there was marked diminution of vision, even though since infancy his vision was below normal. In the third grade he could not read writing on the blackboard and his gait was staggering. There were no headaches. He was admitted on October 26, 1951, with a diagnosis of brain tumor, suspected.

Physical examination: mainly negative. Temperature normal, laboratory examinations of blood count, BSR, blood pressure and pulse normal, Tuberculin skin test and Wassermann reaction negative. Mental age 6 years. There were a disrespectful attitude and silly jocularity, baby talk (puerilism), and in general a trifling state of mind.

N.E.: Righthandedness. Sensorium according to his age. Sensory and motor examination normal. Reflexes: patellary reflexes hyperactive on either side, pathological reflexes: Babinski, Gordon II, Oppenheim, Chaddock, Rossolimo present on the right side; on the left side Gordon II and Oppenheim questionable. Cranial: Macewen's sign. Pain on pressure of the occipital points. Blurred discs and secondary atrophy of the optic nerves. The retinal veins were quite tortuous. Minimal venous backflow on the right. Vision on the right side reduced to perception of bright light only, on the left the acuity is 1/36. Pupils react slowly to L and C. Horizontal nystagmus is more pronounced to the left than to the right. Otherwise the cranial nerves are not remarkable. Supporting reaction is more evident on the right. There is moderate adiadochokinesis more on the right than on the left and marked pronation on the left arm which is being corrected frequently. Knee heel

test: dysmetric on the left. Romberg: questionable tendency to the right. Walking a straight line is performed atactically. Walking blindly the patient shows deviation to the left. CSF normal.

Roentgenograms: 1. Flat films of skull show separation of all the sutures and increased digital markings. There appears to be a cloudy and circular shadow of

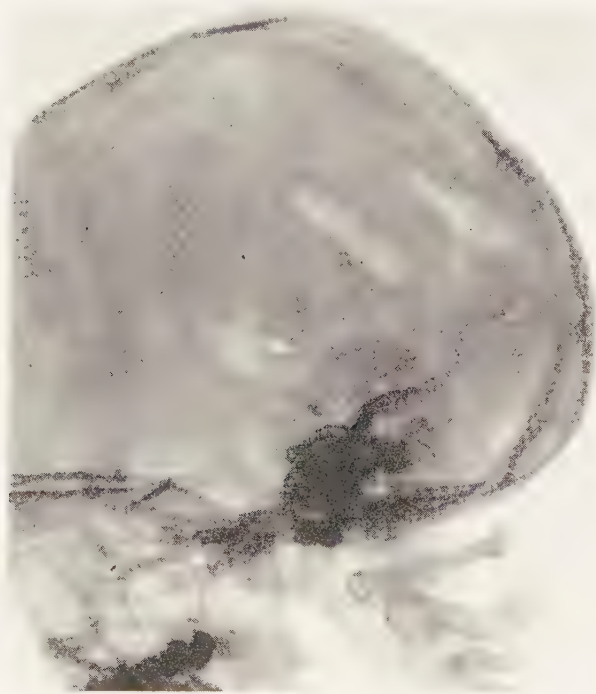


Fig. 1.

Case 1. Pneumoencephalogram, lateral view, showing a filling defect in the posterior superior part of the third ventricle and dilatation of the occipital horns.

somewhat less than bony density in the pineal region. On the lateral film it has a diameter of approximately 3 cm.

2. Lumbar encephalography according to *Lindgren* (16, 17): The rostral third of the aqueduct is shifted basally. There is a filling defect in the posterior part of the third ventricle and moderate to marked dilatation of both lateral ventricles (Fig. 1).

3. Additionally performed ventriculography shows the floor of the left lateral ventricle to be pushed upwards and laterally in the region of the trigone.

4. Percutaneous left carotid angiography with 35 % Umbradil: in the arterial phase it is evident that the tumor derives its vascular supply from the pericallosal and choroid arteries. The venous phase contrasts the tumor very well by the depot of contrast medium in its "capsule".

Diagnosis: Tumor of the area of the quadrigeminal plate extending more to the left, impinging upon the origin of the aqueduct and partially filling the third

ventricle. This tumor extends beneath the left trigone, is partially calcified and does not seem to show infiltrative growth.

Operation: By osteoplastic craniotomy the dilated left ventricle is approached from the posterior parietal region. The ependyma of the floor is split in a cross-wise manner and the lateral portion of the tumor lies immediately beneath it.

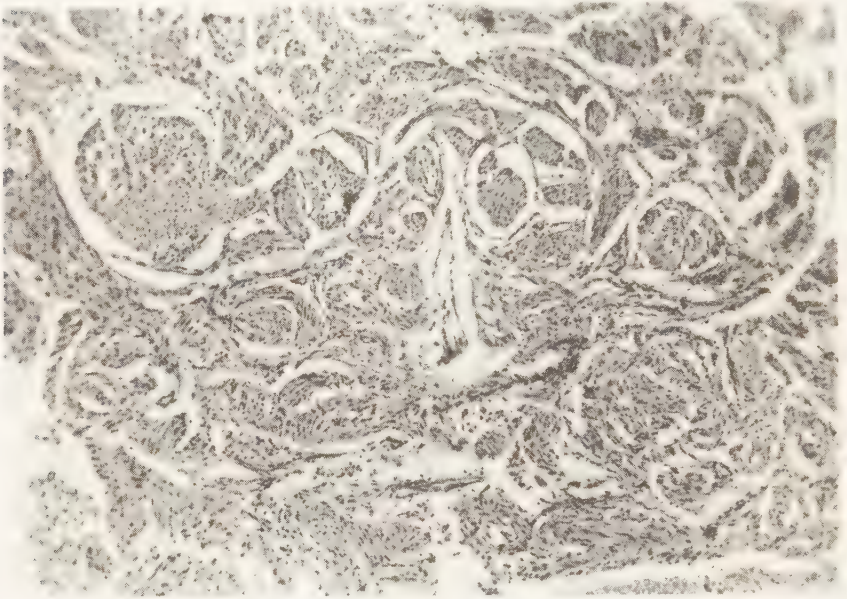


Fig. 2.

Case 1. Photomicrograph. Hematoxylin-eosin. Meningioma.

The tumor proves to be well demarcated, cystic and of gelatinous consistency. It extends beneath the fornix towards the quadrigeminal plate into the third ventricle. There is no connexion with choroid plexus but distinct adhesion to the velum interpositum. Clipping the supplying arteries and the draining terminal vein, the tumor is removed totally with concomitant opening of the third ventricle along the taenia thalami. Incidentally, a small cyst is found on the dorsolateral surface of the thalamus, the superficial wall of which is resected. Inspection of the site of the tumor macroscopically shows no residua. After careful hemostasis the wound is closed.

Microscopical examination of the removed tumor shows edematous tissue with cystic degeneration; the prevailing structures presented the typical picture of an endotheliomatous meningioma with psammoma bodies interspersed very occasionally. There are elongated vessels with pseudorosette formation of spindle-shaped cells around them in a few other places. The tumor as a whole is very vascular and shows an abundance of collagenous fibers. *Diagnosis:* immature meningioma (Professor Konschegg) (Fig. 2).

Postoperative course: Immediately after extubation the child was fully conscious and cooperative. Healing of the wound was uneventful. During the first ten days a disturbance of temperature regulation was evident, with a septic or irregular

type of temperatures. The child was feeling well and showed no other disruption of autonomic functions. There was coarse tremor of action. The signs of an aseptic meningitis subsided within the same period of time. Six weeks after operation there were no neurological deficits except that the right pupil was slightly dilated and the reaction to light was reduced. The vision had not improved.—Reexamination after eighteen months showed a mental age of nine and a half years, physical and neurological examinations were negative. The secondary atrophy of the optic nerves is the only residual.

Case 2.

H. S. admittance number 104653. A 14 year old girl of approximately normal mental and physical age was admitted with the following history. Aged 4 years she developed a divergent strabismus of the left eye with an unsuccessful attempt at repair at the age of 11. 9 months prior to this admission headaches developed which were localised frontally during the last two months. During this time also, there was a decrease of auditory acuity on the left and sometimes vomiting in the morning.

Physical examination reveals a pigmented naevus just above the left clavicle. Hypertrichosis of cheeks, arms and back. The menstrual cycle has not started yet. There are no abnormalities of the cardio-vascular, respiratory, G. I., and G. U. systems.

N. E.: No history of birth trauma in this right-handed girl. Sensory: normal. Motor: There is a suggestion of cog-wheel rigidity of both arms, not of the legs. There is a cracked-pot sign. The cranial nerves show the blind spots enlarged, otherwise the visual fields normal, choked discs of 3 diopters on the right and 4 to 5 on the left. There is complete paralysis of the third and fourth nerves on the left, paralysis of the right peripheral seventh nerve. Complete loss of function of the left acoustic nerve, while caloric stimulation of both labyrinths shows normal response. There is paralysis of the left recurrent nerve. Reflexes: Corneal reflexes diminished the right more than the left. All tendon reflexes are diminished. A questionable right plantar response is the only pathological reflex. Cerebellar: Right finger-to-nose test dysmetric. Knee-heel test normal. No Romberg sign. Walking blindly the girl deviates to the right. Ventricular CSF normal.

Roentgenograms: 1. A flat plate of the skull reveals separation of the coronal suture, enlargement of the sella, increased digital markings. The choroid plexus of the body of the right lateral ventricle is calcified.

2. Percutaneous left carotid angiogram. Internal hydrocephalus, the vein of Galen situated normally.

3. Ventriculogram. The pressure is raised to 290 mm of water. Symmetric dilatation of both lateral and the third ventricles. A mass is projecting into the posterior superior part of the third ventricle with subsequent complete obstruction of the aqueduct. The trigones of both lateral ventricles are engorged from a caudal and medial direction by this mass. Additional films after injection of 3 ml of a positive contrast medium (Myodil) confirm these findings (Fig. 3).

Diagnosis: Tumor at the pineal region causing complete obstruction of the aqueduct.

Following ventriculography the right lateral ventricle is drained for ten days, after which time pulse, temperature and respiration are normal again.

Operation: After intubation the patient is placed in a sitting position. A left occipital bone flap is turned down and the occipital pole retracted laterally with-

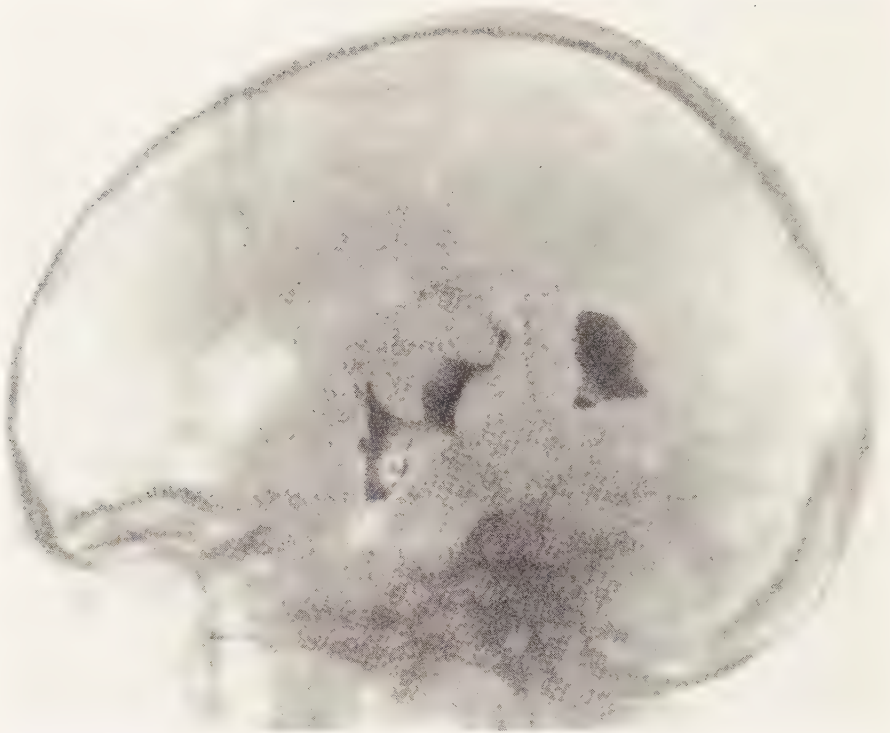


Fig. 3.

Case 2. Ventriculogram with air and Myodil, lateral view. The tumor is projecting into the dorsal upper part of the third ventricle causing complete obstruction of the aqueduct.

out sacrificing any bridging veins. The tentorium is split parallelly to the straight sinus, 1 cm laterally to it. Immediately beneath it a tumor mass is encountered as shown in Fig. 4. It is well demarcated and after incising its capsule it is removed bit by bit with a pituitary rongeur. In so doing the space obtained allows an appraisal of the size and relationship of the tumor to its environment. The main part of the tumor is adjacent to the quadrigeminal plate; rostrally it pushes the tela choroidea of the third ventricle forward and bilateral extensions protrude into the ambient cisterns. Especially the left part of the tumor reaching the cistern is large and receives its vascular supply through branches of the posterior cerebral and anterior superior cerebellar arteries. After clipping these and other arteries it is possible to remove the capsule with the remaining part of the tumor completely. The site of the most peripheral parts of the tumor, as seen after its removal, correlates well with the radiological findings. Thus between the crura fornix is there is a pea-sized extension of the cavity pointing frontally beneath the splenium of the corpus callosum, where, however, there is no visible communication with the third ventricle. The main part of the cavity presents itself as a deep indentation of the wall of the third ventricle, and the tumor had also pressed against the quadrigeminal plate and brachia of the left collicles. The large veins

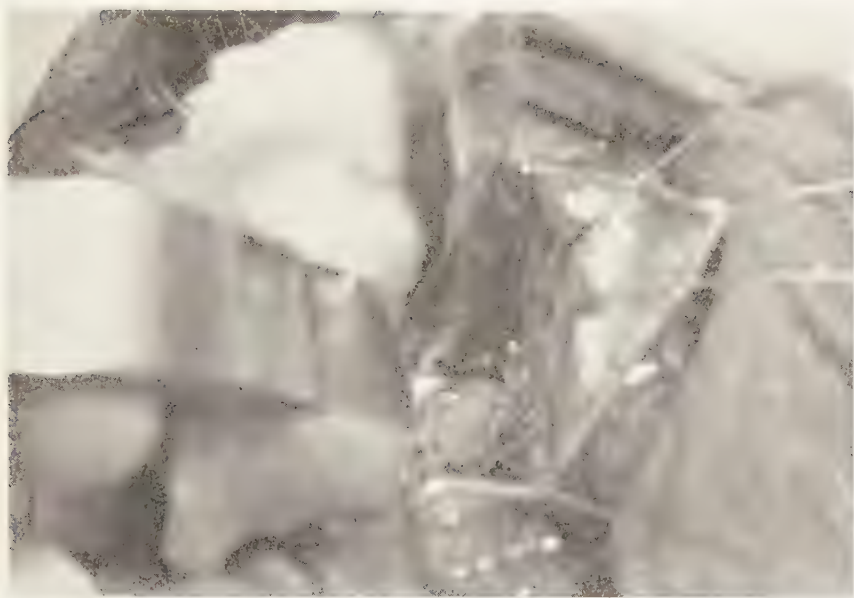


Fig. 4.

Case 2. By retraction of the left occipital pole and splitting the tentorium the extraventricular portion of the tumor is exposed. Its supplying arteries running along the left ambient cistern and the brachia of the left collicles are clearly visible.

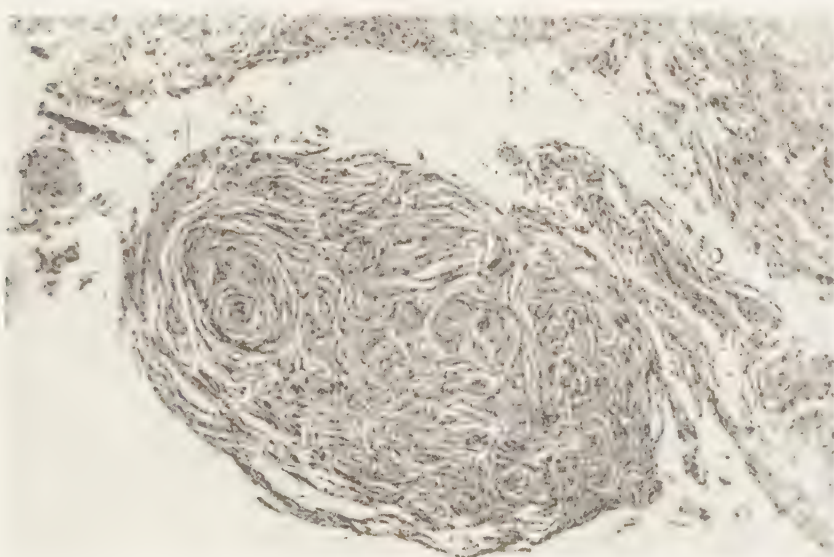


Fig. 5.

Case 2. Photomicrograph of the tumor shows the appearance of a typical endotheiomatous meningioma. Hematoxylin-eosin, 140.

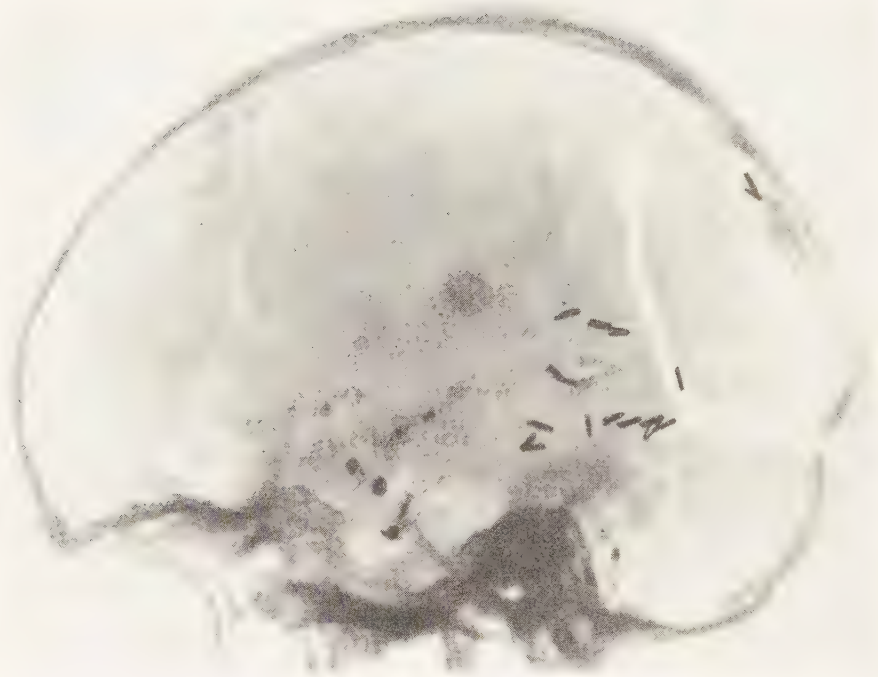


Fig. 6.

Case 2. X-ray of the skull on 19th postoperative day proving the restored CSF circulation by disappearance of the main part of the contrast medium from the ventricles. These are still outlined showing considerable regress of dilatation.

could be left untouched and bleeding is minimal. The quick frozen section as examined by Professor Korschegg reveals a meningioma. The incision in the tentorium is left open and the wound is closed in a routine manner.

Pathological examination: The total weight of the removed tumor is 10 grams. Microscopically the tissue represented the appearance of an endotheliomatous meningioma (Fig. 5).

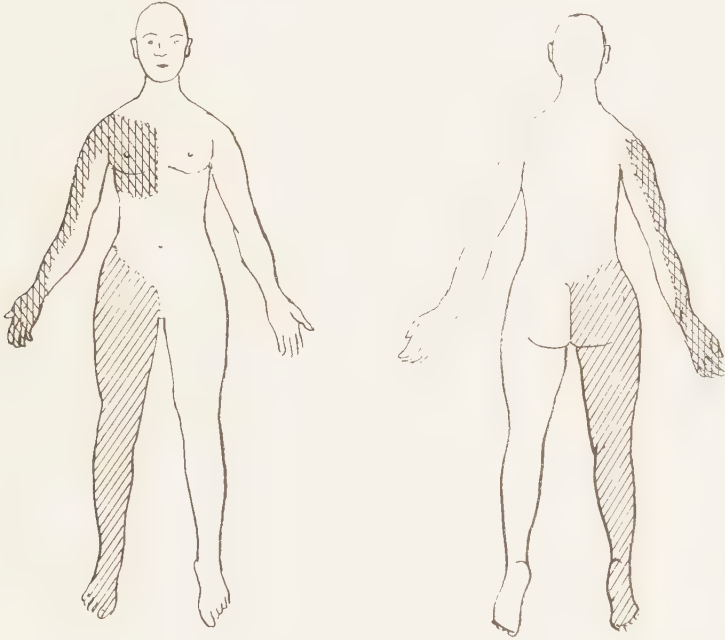
Postoperative course: There is little if any disturbance of autonomic functions. On the second postoperative day there was an episode of hallucinations for a few hours, on the fourth day there was a feeling of "stiffness" in the right arm. On the seventh day a neuroparalytic keratitis of the left cornea developed, which receded after a week under acetylcholine ointment medication. Radiological control on the fourteenth and nineteenth day showed that the contrast medium had mainly disappeared from the ventricles, which showed the restored CSF circulation through the aqueduct. Also the dilatation of the ventricles had regressed as appears from Fig. 6.

Neurological follow-up. On the eighteenth postoperative day: The paralysis of the left fourth nerve had disappeared while the left third nerve was still paralysed. Fundoscopically, the right disc was still blurred, with no measurable choking, while on the left there was still choking of two diopters. The right corner of the mouth was not well innervated yet, auditory acuity normal bilaterally. The left

vocal cord was not moved yet. The left corneal reflex was still somewhat reduced. Tendon reflexes and tone of the extremities reduced. No pathological reflexes. Disturbance of sensation is shown in the accompanying diagram.

The patient was discharged on the 22nd postoperative day.

Three months after discharge the neurological follow-up revealed no defects



Loss of
sensation of
pain



Diminution
of tactile
sensation



Loss of
temperature
sense

except for a paresis of the left third nerve and left recurrent nerve. By X-ray examination it was found that the contrast medium had accumulated in the sacral subarachnoid space, from where it was removed by tapping under fluoroscopy. The child was free of complaints and was able to lend a helping hand to her father on his farm. A second attempt to repair the remaining strabismus is planned in about six months.

DISCUSSION

The velum interpositum represents a double fold of the pia arachnoid, which during the development of the telencephalon is placed in

that substance of the cerebrum which is covered by the progressive growth of the corpus callosum. For that reason the formation of meningeal tumors in that region is understood. In the afore-mentioned cases the tumors showed no relationship whatsoever to the choroid plexus of the third ventricle. In that respect as well as by their microscopical appearance they have no resemblance to the cysts of the plexus of the third ventricle described by *Hambüchen* (12). Additionally, their localization in the posterior portion of the roof of the ventricle excludes their interpretation as derivative of paraphysial cysts.

In case 1 the atrophy of the optic nerves, mental retardation, and neurological signs are well explained by the increased intracranial pressure caused by mechanical obstruction of the aqueduct. The monoparesis of the right leg is an obvious result of the pressure towards the left cerebral peduncle or on the right internal capsule. The horizontal nystagmus may be conceived as a sequence of compression of the superior cerebellar peduncles. In view of the close vicinity of the tumor to the quadrigeminal plate it is interesting to note that there were no signs resembling a Parinaud's syndrome.

In case 2 the symptoms can be accounted for by the site of the tumor. The loss of sensibility of the cornea results from a compression of the rostral part of the tectum. It is noteworthy that the keratitis occurring in the postoperative course apparently arose from a disturbance of the mesencephalic nucleus of the trigeminal nerve. The cause of the transient perturbation of sensation in the right side of the body may be explained by a passing edema of the medial lemniscus and the spino-thalamic tract at the trigonum lemnisci.

SUMMARY

The velum interpositum is an unusual site for meningiomas to arise. Meningiomas as such rarely occur in childhood. Two cases of meningiomas in children occurring in the location mentioned are reported, their removal is described and the symptomatology discussed. *Acknowledgment.* I am obliged to Dr. Vogler for performing the angiograms.

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A STATISTICAL REVIEW OF "PSYCHICAL SYMPTOMS IN NEUROSURGICAL DISEASE". BY E. BUSCH

By

A. E. MAXWELL

This article which appeared in *Acta Psychiatrica et Neurologica* Vol. XV, 1940, was referred to me for a statistical examination. However, since the topic with which the article deals is of acknowledged complexity, it was understood that a statistical analysis of the data without specific reference to the many and diverse problems involved, would be almost as impossible as it would be dangerous. The reviewer then seeks indulgence for any comments other than statistical ones he felt obliged to make.

There seem to be at least three desiderata if insight regarding the links between brain and mind is to be gained through the study of brain-damaged patients:

- (a) The location of lesions must be verified when possible.
- (b) Psychological and psychiatric assessment of mental function must be carried out by trained observers using well standardised tests, and clearly defined terminology.
- (c) Exact statistical hypotheses concerning the associations between findings in (a) and (b) should be tested whenever possible.

This review, even if it should be found to have no merit apart from demonstrating (c), may serve a useful purpose.

CREDIT AND DEFECT

The article under review is outstanding with regard to (a) in that the sites of brain lesions in 662 patients (355 of whom will come under review here) have been verified. The study is inadequate with regard to (b) – a point which Busch realises only too well – consequently it is difficult to proceed to (c) with conviction. However, as Busch's article

commands respect due to its excellence regarding (a), it seems very worth while to see if a statistical examination could add anything to the conclusions reached by him.

The general "symptom" headings under which Busch classified his data are choked discs, torpor, special symptoms (elaborated later), impaired memory, dyscalculia, and aphasia. The incidence of choked discs was noted as "a gross but convenient indicator of increased intracranial pressure". The discs referred to are situated in the back of the eye, and while normally appearing as concave discs they become convex and bloated when intracranial pressure is abnormally high.

"Under torpor are listed the patients showing the torpidity frequently met with in intracranial pressure". By torpidity is meant a lack of response to normal or ordinary stimuli—in short, a damping down of the faculties.

Apart from these two general symptoms there remain the four more purely "psychical" symptoms to which Busch directs especial attention and of which more shortly.

The data under the six symptoms headings is summarised in Table I. It contains the totals given in tables 2, 3, 5, 6, 7 and 9 of Busch's article. The localization sites represented in these tables are respectively:

- I. Gliomas (tumors) of the anterior part of the cerebrum.
- II. Gliomas of the temporal lobes.
- III. Gliomas of the cerebral hemispheres excluding tumors of frontal and temporal lobes.
- IV. Deep-seated cerebral gliomas, i.e. around or in the third ventricle.
- V. Infratentorial gliomas, i.e. tumors situated below the cerebral areas and so not affecting parts concerned with symbolic function.
- VI. Meningiomas, i.e. extracerebral lesions connected with the tissue sheaths—the dura mater and pia-arachnoid—which enclose the brain.

DEFINITION OF TERMS

The first point to note about the data in Table I is that the columns are not independent. This is seen by comparing the total in each line with the sum of the other entries in that line. This means that patients have shown in general more than one symptom—a natural happening—but we are not given detailed information as to what patients showed what symptoms and must proceed to our analysis without it.

The next point needing discussion is the meaning which Busch attaches to the symptoms, impaired memory, dyscalculia and aphasia.

TABLE I

Frequencies and percentage frequencies of Psychological Symptoms for Lesion Sites I-VI.

Site	No. of Patients	Frequency of Symptoms											
		Choked Discs		Torpor		Special Symptoms		Impaired Memory		Dys-calculia		Aphasia	
I	47	35	74%	28	60%	22	47%	30	64%	28	60%	13	28%
II	28	7	25%	4	14%	14	50%	10	36%	11	39%	12	43%
III	75	47	63%	26	35%	42	56%	38	51%	38	51%	20	27%
IV	43	36	44%	14	33%	29	67%	28	65%	29	67%	4	9%
V	64	59	92%	25	39%	8	13%	11	17%	9	14%	10	16%
VI	98	26	27%	48	49%	48	49%	62	63%	49	50%	14	14%
Total	355	210		145		163		179		164		73	

Aphasia is diagnosed by means of a brief test "comprising notes on spontaneous speech, polysyllabic test-words, test for motor, sensory and amnesic aphasia, writing after dictation, tests for apraxia and for the recognition and production of a current melody".

The common definition of the term aphasia (dysphasia) implies disorders of speech reflecting impairment in the comprehension and use of symbols (words and numerals). In as far then as numerals as well as words are implied, dyscalculia and aphasia cannot be thought of as mutually exclusive terms. Not only then are the columns in Table I non-independent but it would appear logical to suspect that the symptoms being noted are also correlated.

The presence of dyscalculia was detected by a "mental arithmetic" test involving "simple additions, subtractions and multiplications". Here rote memory, if not also recall, is certainly involved, and, as the test is one of "mental arithmetic", the possibility that aphasia also is present cannot be ruled out. The term dyscalculia (acalculia) was introduced into the literature of brain localization by Henschen, who postulated a centre for it. Busch probably has Henschen's meaning of the word in mind though not himself subscribing to Henschen's extremist view regarding its localisation. What does appear clear is that Busch is referring only to gross and undisputed impairment in the ability to calculate—see 1, p. 261.

Finally we come to the symptom "impaired memory". Reading and memory were tested by reading and subsequent examination in a little highly dramatic story". Here again there would appear to be some correlation with aphasia but we take it that what Busch has listed are cases in which memory impairment was an outstanding symptom.

TABLE II

Observed and Expected Frequencies for Impaired Memory for Lesion Sites I to VI.

	Observed (O)						Total
	I	II	III	IV	V	VI	
Symptom not recorded	17	18	37	15	53	36	176
Symptom recorded	30	10	38	28	11	62	179
Total	47	28	75	43	64	98	355

Expected (E)							
	23.3	13.9	37.2	21.3	31.7	48.9	176
	23.7	14.1	37.8	21.7	32.3	49.4	179
Total	47	28	75	43	64	98	355

(O-E) ²	1.704	1.222	0.001	1.873	14.258	3.260	22.318
E	1.675	1.201	0.001	1.841	14.020	3.206	21.944
Sum	3.379	2.423	0.002	3.714	28.278	6.466	44.262 = χ^2

A PRELIMINARY ANALYSIS

With these considerations in mind let us turn to the data in Table I. A cursory glance is sufficient to show that all symptoms occur to a greater or lesser extent with all sites of lesion. Each column however, was examined separately by the chi-square technique for possible significance of special association between symptoms and sites of lesion. In doing so the reviewer was always mindful of the warning expressed recently by Macdonald Critchley (2, p. 407) and before him so emphatically by Hughlings Jackson, and by P. Marie and others, of committing "the fallacy of confusing localisation of sign-producing lesions with localisation of function".

As an example of the statistical procedure adopted, details of the tabulation of the data and of the calculations required in the case of "impaired memory" are given in Table II below.

The total number of patients involved is 355. The number having the symptom is 179, leaving 176 for whom the symptom was not recorded. An hypothesis was tested, namely, that there is no significant variation among the lesion sites in the tendency to show the symptom. For this purpose the patients from each group were regarded as a

TABLE III

Percentage Occurrence of Symptoms and Details of the Composition of Each Chi-Square with Significant Contributions in Italics.

Site	Choked D Discs	Torpor	Special Symptoms	Impaired Memory	Dys- calculia	Aphasia
I	4.59 74%	6.82 60%	0.02 47%	3.38 64%	3.38 60%	1.45 28%
II	13.52 25%	8.18 14%	0.18 50%	2.42 36%	0.54 39%	8.52 43%
III	0.38 63%	1.19 35%	3.08 56%	0.00 51%	0.50 51%	1.71 27%
IV	10.74 44%	1.22 33%	8.01 67%	3.71 65%	7.81 67%	3.34 9%
V	28.90 92%	0.08 39%	28.77 13%	28.28 17%	26.57 14%	0.96 16%
VI	43.19 27%	2.68 49%	0.37 49%	6.47 63%	0.57 50%	2.36 14%
χ^2	101.32	20.17	40.43	44.26	39.47	18.34

sample from a population of brain-damaged patients in which the ratio of those showing the symptom to those not showing it is 179: 176. Details of the calculation of chi-square as done here may be found in Weatherburn's book, (4, P. 176). Hypotheses similar to the above were tested for each of the six groups, and in each case the chi-square was highly significant.

The entries in the last row of Table II were now transferred to the column labelled "impaired memory" in Table III. This indicates how the data in the latter table was obtained.

Beside each entry is given the percentages of patients examined who showed the symptom. By forming a cumulative sum of the entries from smallest to largest in each column and by taking appropriate degrees of freedom (one less than the number of entries taken), at each stage of the cumulative process, entries responsible for the significant chi-square can be picked out. These are *underlined*. From them and the percentages alongside the following conclusions regarding special associations between symptoms and sites of lesion can be drawn.

Choked discs.

This symptom while being of relatively general occurrence is found, from Busch's data, to be significantly associated with infratentorial lesions (defined later), deep-seated cerebral lesions and lesions in the frontal lobes. It is significantly dissociated from lesions in the tissue sheaths which enclose the brain and from lesions in the temporal lobes. Busch remarks with emphasis (1, p. 272) that "the supposition of increased intracranial pressure as an important factor in the production of psychical symptom is untenable". This conclusion is certainly borne

out by his data. In table III we see that whereas 74 % of the patients with frontal lesions have choked discs there is no evidence of spread of effect since no significant association has been established between this site and any other symptom except torpor. Or again 63 % of the patients with lesions in the parietal-occipital areas had choked discs but there is no significant association between lesions in this site and any symptom. The reader can supply himself with further evidence by examining Table III.

Torpor.

This symptom is only just significantly associated with lesions in the frontal lobes, but is significantly dissociated from lesions in the temporal areas. It is of fairly general but only relatively frequent occurrence. Busch (I, pp. 272-3) thinks that it is the only symptom which seems to be related to intracranial pressure and gives clinical evidence to support this claim. Unfortunately the data in Table III, except for site I, does not lend much support to the suggestion.

Special Symptoms.

These symptoms—to be elaborated below—are significantly associated, statistically speaking, with deep-seated cerebral gliomas around or in the third ventricle. They are significantly absent where infratentorial gliomas, that is, gliomas in the roof of the fourth ventricle and cerebral hemispheres are concerned, and are also significantly absent where lesions affecting the pons and medulla oblongata, that is the brain stem, are concerned.

Impaired Memory.

This symptom is only just significantly associated with gliomas in the third ventricle, but highly associated with meningiomas of the sagittal sinus of which more later. It is significantly absent where infratentorial lesions are concerned.

Dyscalculia.

Here again there is significant association with lesions in the roof and sides of the third ventricle, and significant dissociation in the presence of infratentorial gliomas.

TABLE IV

Details of Incidence of Psychical Symptom and Site of Lesion.

Site of Lesion		Pat- ients	Special Symptoms	Impaired Memory	Dys- calculia	Aphasia
I	1. Left Frontal Gliomas ...	22	3 14%	14 64%	14 64%	12 55%
	2. Right Frontal Gliomas .	16	11 69%	9 56%	8 50%	0
	3. Both Frontal Lobes	9	8 89%	7 78%	6 67%	1 11%
II	4. Left Temporal Gliomas .	16	7 44%	7 44%	8 50%	12 75%
	5. Right Temporal Gliomas	12	7 58%	3 25%	3 25%	0
III	6. Left Hemisphere	33	15 45%	16 49%	18 55%	20 61%
	7. Right Hemisphere	42	27 64%	22 52%	20 48%	0
IV	8. Around or in the third Ventricle	43	29 67%	28 65%	29 67%	4 9%
V	9. Roof of the fourth Ven- tricle and cerebellar hemispheres	52	5 10%	7 13%	6 11%	10 19%
	10. Pons and Medulla	12	3 25%	4 33%	3 25%	0
VI	11. Parasagittal of Anterior Third of Sinus; Supra- sellar; Ethmoidal; of Anterior part of Con- vexity	36	25 69%	31 86%	22 61%	4 11%
	12. Parasagittal of Poster- ior two thirds of Sinus; of Falx; of Posterior part of Convexity	35	13 37%	18 51%	15 43%	7 20%
	13. Sphenoidal Ridge	19	4	7	8	2
	14. Intraventricular	5	5 } 37%	5 } 41%	4 } 44%	1 } 11%
	15. Infratentorial	3	1	1	0	0

Aphasia.

Here lesions in the temporal lobes are the chief offenders, while lesions around and in the third ventricle are significant for the absence of aphasic effect. It is surprising to find aphasic effects reported for as many as 16 % (10 out of 64) of patients with infratentorial gliomas since such gliomas are below the cerebral areas proper. One can only assume that in the case of some of the patients the tumors were not entirely confined to the site in question.

A DETAILED ANALYSIS

The fruitfulness of this overall examination prompted a more detailed study taking into account the greater detail which Busch gives

regarding lesions in each of the sites I to VI above. The results here obtained are worth quoting however, (as well as the more detailed results to follow) since contrast as well as comparison is provided. As the aim was to concentrate on the psychical aspects of Busch's paper it was thought admissible to omit the symptom "choked discs" from further discussion. Torpor too was omitted as the examination just reported did not suggest that further investigation would reveal any more specific information.

One feature which immediately attracts attention now concerns the observed incidence of aphasia. As one would expect the symptom is virtually absent from patients with lesions in the non-dominant hemisphere. This fact contrasts with the corresponding data in the other columns where incidence of symptoms is well distributed.

Busch, however, contends "that psychical defects seem more frequent in patients having left-sided tumors"; and regarding the temporal lobes, he states that "the predominance of psychical defects in left-sided tumors is still more marked than was the case in the (left) frontal tumors". He cites the frequent incidence of aphasia accompanying left-sided tumors as a possible cause of this. However, when the frequencies concerned are expressed as percentages, as shown in Table IV, the contrast between the hemispheres is seen to be not nearly so marked as might at first appear. Certainly it is not as marked as one would expect if aphasia were a prime cause, for aphasia is entirely absent where right-sided tumors are concerned.

A more important point than that just mentioned refers to the infrequent occurrence of "special symptoms" with left-sided tumors compared with the frequency of their occurrence with right-sided tumors. This contrasts noticeably with the incidence of aphasia. Both this point and the earlier one will be dealt with more fully when reference is being made to Table VI. Here we shall try to clear up another issue raised by Busch.

TYPE OF LESION VERSUS HEMISPHERE

Busch remarks that "much confusion as to psychological symptoms in intracranial tumors is certainly due to a comparison between 'gliomas': ... no comparison can be drawn between a glioblastoma of one hemisphere and an astrocytoma on the other". By glioblastoma are meant malignant tumors. They contrast with astrocytomas, which, as yet, are benignant tumors, and one of the points Busch proceeds to make is that the more frequent occurrence of "special symptoms" with right-sided

TABLE V
Frequencies of Lesions in the Hemispheres.

Site	Left Hemisphere			Right Hemisphere		
	A	B	C	A	B	C
I	15	6	1	8	3	5
II	12	2	2	9	2	1
III	15	10	8	19	14	9
Total	42	18	11	36	19	15

tumors (at least in the frontal lobes) may be due to a greater incidence of glioblastomas in the right side.

Busch's other point is that it would not be altogether unexpected to find glioblastomas more frequently in the right side since patients with right-sided tumors would not suffer from aphasia to the extent that patients with left-sided tumors would and so would not come for treatment as soon.

One question that we can attempt to clarify here is whether glioblastomas do in fact occur more frequently in the right side among Busch's patients.

The frequency of occurrence of *A*, astrocytomas; *B*, glioblastomas; and *C* other lesions (largely comparable to glioblastomas) with regard to left and right hemispheres for the sites numbered I, II, and III are quoted by Busch and are reported in Table V.

The totals for the left and right hemispheres were compared by means of a chi-square test to see if they disagreed with each other more than could be attributed to chance. The test was far from being significant. Even if the nine glioblastomas (table IV, row 3) are added to the frequencies for either left or right hemisphere chi-square is still not significant. Next the frequencies for each separate site (combining *B* and *C*) were compared but again there were no significant differences between the hemispheres. What is worth noting is that "glioblastomas" and "other lesions" have been observed by Busch more frequently for both hemispheres alike in the parietal-occipital lobes than in either the frontal or temporal lobes.

In the light of this evidence we cannot easily accept a suggestion that there is association between the kind of tumor and the hemisphere in which it is normally met. This fact must be borne in mind when commenting on the data in Tables IV and VI.

DISCUSSION OF RESULTS

We may return now to Table IV. Chi-square tests similar to those performed earlier were now carried out for each of the four columns. To meet the generally accepted statistical requirement of the chi-square test that all expected frequencies be greater than 5, some grouping of rows was necessary. This, however, was done in such a way as to keep the data for left and right hemispheres separate thus making possible a closer examination of possible differences between them.

With reference to the numbering of the lesion sites in Table IV, the grouping was as follows: (1, 4), (2, 3, 5), 6, 7, 8, 9, 11, 12, (10, 13, 14, 15).

The results of the chi-square tests are given in Table IV. This table compares with Table II, and an interpretation of the results follows:

TABLE VI

Percentage Occurrence of Symptoms and Details of the Composition of Each Chi-Square With Significant Contributions in Italics.

Site	Special Symptoms		Impaired Memory		Dyscalculia		Aphasia	
1, 4	5.92	29%	0.36	55%	2.09	58%	42.21	63%
2, 3, 5	8.84	70%	0.13	51%	0.00	46%	7.23	3%
6	0.00	45%	0.05	49%	0.93	55%	32.39	61%
7	5.71	64%	0.06	52%	0.03	48%	10.87	0%
8	8.02	67%	3.71	65%	7.81	67%	3.34	9%
9	26.60	10%	28.42	14%	25.13	12%	0.06	19%
11	8.03	69%	19.34	86%	3.22	61%	1.97	11%
12	1.08	37%	0.01	51%	0.16	43%	0.01	20%
10, 13, 14, 15	2.49	32%	0.73	44%	0.94	38%	3.95	8%
Chi-square	66.69		52.81		40.31		102.03	

Here again the relative generality of occurrence of the symptoms should be emphasised and kept constantly in mind. Attention, however, is concentrated on statistically significant associations.

Impaired memory.

The most interesting finding here is that the incidence of this symptom which in the earlier analysis (where the degree of freedom was smaller and where the grouping did not allow the contrast between the hemispheres to be felt) was significantly associated (just at the 5 % level) with lesions around and in the third ventricle is no

longer found to be so. The symptom still is highly associated with meningiomas in the sagittal sinus, and other meningiomas in areas indicated in row 11 of Table IV. It is as expected significantly absent where infratentorial gliomas are concerned. These findings are important.

Busch in his summary says that "impaired memory and dyscalculia seem . . . dependent on the nature and localization of the lesions, being most frequent in extracerebral lesions affecting the frontal lobes (meningiomas) and intracerebral lesions around the third ventricle gliomas". Our results do not support Busch's conclusion regarding a special association between impaired memory and the intracerebral lesions in question. It is worth mentioning too that Williams and Pennybacker (3, p. 115) quote Busch on this point in support of their findings that "memory impairment is most common and specific when the area surrounding the floor and wall of the third ventricle is disturbed." This support from Busch's data would appear from our analysis to be weak, and further evidence would be valuable.

Dyscalculia.

Here the results are as found earlier—association between the symptom and gliomas around and in the third ventricle being statistically significant, while the incidence of the symptom is significantly absent, as one would expect, in the case of infratentorial gliomas.

Another problem presents itself here. Readers of Macdonald Critchley's book (2), in particular his chapter on disorders of language and symbolic thought will associate dyscalculia (and dyslexia) with lesions in the parietal lobes. Busch's data gives no statistically significant evidence for any special association between dyscalculia and such lesions. But—may it be emphasised again—this does not mean that dyscalculia is not observed frequently where lesions of a dominant parietal lobe are concerned.

Aphasia.

Here the more detailed analysis emphasises the contrast between the hemispheres. Gliomas in the dominant hemisphere are very significantly accompanied by the symptom. The symptom is absent where lesions in the right hemisphere are concerned. This contrast between the hemispheres is reversed in the case of "special symptoms", but there is no contrast where "impaired memory" and "dyscalculia" are concerned. One can only conclude that these latter symptoms are not as closely correlated with aphasia as was thought logical to suspect

from our interpretation of Busch's definition of these terms. Discrepancies of this kind serve to emphasise the need, expressed earlier, for a clearly defined terminology if clarity is to be achieved in this field.

Special Symptoms.

In keeping with the title of his article, Busch gives detailed information about the "psychical symptoms" subsumed under this collective heading. The symptoms referred to are seven in number—1. Psychosis (under this heading only cases seen by a psychiatrist are listed the diagnoses being paranoia, mania, dementia praecox and manic-depressive psychosis); 2. Moria; 3. Euphoric Fatuity; 4. Organic Dementia; 5. Post-paroxysmatical derangement; 6. states of exaltation; and 7. Depression and psycholability. Details of the incidence of their occurrence are given in Table VII in which table column entries are independent. The differences between Busch's and British terminology is evident here, but Busch admits that he is himself on unfamiliar ground and makes a special effort to explain what each term—with the exception of Moria—means. Moria in psychiatry, we take it, means a morbid tendency to joke.

The totals and percentages at the bottom of Table VII show the relative frequency of the symptoms concerned. A chi-square test carried out on the assumption that equal frequencies might be expected for each symptom was highly significant and while proving the obvious served the purpose of directing attention to columns 7, 4, 5 and 3 in that order. Chi-square tests similar to those done earlier were carried out for each of these columns, but no significant associations were established. We must then fall back on the results given in Table VI. These special symptoms were found to be very significantly associated with lesions in the right hemisphere, lesions around and in the third ventricle and with meningiomas in the anterior third of the sagittal sinus, (i.e. a vein of the brain in the saddle between the frontal lobes), and other areas mentioned in row 11 Table IV. These symptoms are significantly absent in the case of gliomas in the left hemisphere and in cases of infratentorial meningiomas.

Busch's "special symptoms" seem to differ from the other symptoms, namely, impaired memory, dyscalculia and aphasia in that whereas the latter could be thought of primarily as impairments in the cognitive field the former refer especially to psychiatric symptoms. Our analysis (Table VI) then gives a definite suggestion that in contrast with aphasia and its predominant left-sided association psychiatric

TABLE VII
Details of Special Symptoms".

Site		Total No. of Patients	Frequ- ency of Symp- toms	Symptom Number						
				1	2	3	4	5	6	7
I	1	22	3	0	0	0	0	2	0	1
	2	16	11	1	3	2	0	0	2	3
	3	9	8	0	0	2	3	0	1	2
II	4	16	7	0	0	1	0	4	0	2
	5	12	7	0	0	2	0	2	0	3
III	6	33	15	1	0	2	5	1	1	5
	7	42	27	0	1	3	7	6	2	8
IV	8	43	29	2	0	0	11	6	4	6
V	9, 10	64	8	0	0	4	1	0	0	3
VI	11	36	25	0	4	2	5	6	1	7
	12	35	13	0	0	3	3	3	1	3
	13	19	4	0	2	0	0	1	0	1
	14	5	5	0	0	1	2	0	0	2
	15	3	1	0	0	0	0	0	0	1
Total		355	163	4	10	22	37	31	12	47
% of 163				2%	6%	14%	23%	19%	7%	29%

symptoms have a significant right-sided association. This fact Busch tried to explain in terms of the more severe tumors (glioblastomas) being more frequent in the right hemisphere than in the left. That glioblastomas are more severe than astrocytomas nobody need dispute, but no evidence is found here to suggest that the former were more frequently found in the right side than could reasonably occur by chance. A possible indirect cause of the fact that "special symptoms" seem less frequent for left-sided tumors may be the higher incidence of aphasia in the latter cases which could militate again the detection of these psychiatric symptoms.

SUMMARY

A summary of the conclusions reached in this statistical examination can best be made with an eye on Table VI. One very important thing to keep constantly in mind is that with the exception of aphasia the symptoms noted are of very general occurrence wherever the site of the intracranial tumors.

No evidence can be found in Busch's data to suggest an association between the kind of tumor and the hemisphere in which it is met.

Busch's claim "that the supposition of increased intracranial pressure as an important factor in the production of psychical symptoms is untenable", is well borne out by the statistical analysis of his data.

Regarding special association the reviewer agrees with Busch that there is a special association between impaired memory and extracerebral lesions affecting the frontal lobes (meningiomas) but has found no statistically significant evidence to suggest that this special association can be extended to include intracerebral lesions surrounding the third ventricle.

He also agrees with Busch that dyscalculia is significantly associated with intracerebral lesions surrounding the third ventricle, but cannot demonstrate a significant association between dyscalculia and extracerebral lesions in the frontal lobes. Nor can the reviewer demonstrate, on the basis of Busch's data, any significant association between dyscalculia and lesions in the parietal lobes as maintained by other writers.

Aphasia, as expected, is found to be significantly associated with lesions in the left hemisphere, but there is no statistically significant evidence to support Busch's suggestion that this explains "the predominance of psychical defects in left sided tumors" a predominance beyond the limits of chance does not appear to exist in his data.

Finally, if one evaluated Table VI on its face value one must conclude that psychiatric symptoms are especially associated with the non-dominant hemisphere. Efforts by Busch to explain this association by suggesting that patients with right-sided lesions, not suffering from aphasia, do not come for treatment as early as do patients with left-sided lesions so that the right-sided lesions have time to become more severe, can hardly be accepted as convincing in the light of our analysis. An alternative suggestion is that the presence of aphasia caused by lesions in the dominant hemisphere may militate against the detection of psychiatric symptoms or the patient's report of such when that hemisphere is damaged.

ACKNOWLEDGEMENTS

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GEMISTOCYTIC ASTROCYTOMA: CYTOLOGICAL OBSERVATIONS ON THE RATE OF HYDROLYSIS OF SOME PHOSPHORIC ACID ESTERS

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The histochemical method introduced by Gomori and Takamatsu for the demonstration of phosphatases in tissues has been used extensively in normal, pathological and experimental material. Several contributions to the study of nervous tissues have appeared in the literature, but many have been subject to criticism because the methods of fixation employed were believed to alter or reduce the level of enzyme activity. The studies on alkaline phosphatase largely retain their validity and work in the acid range has been more recently shown to be of value when freeze drying is chosen as the method of fixation. Tumours of the central nervous system show a characteristic distribution of enzyme activity and Landow, Kabat and Newman have demonstrated a positive reaction in astrocytomas. They found the alkaline phosphatase reaction stronger in the astrocytic processes than in the cell body. Wolf, Kabat and Newman found that the acid phosphatase content of the tumours correlated with the enzyme content of the cell types from which the tumour derived. They found that the nuclei of neoplastic astrocytes stained deeply and their cytoplasm and often their processes stained moderately. In many areas only nuclei stained. In 1951, Naidoo and Pratt, employing a freeze drying technique adapted for nervous tissue, demonstrated specific and histologically different sites of activity for several phosphatases in the normal brain. It was found that his method showed very high enzyme activity equal in most cases to fresh brain suspensions and that incubation periods of about twenty minutes were sufficient. Further, as biopsy material was readily obtainable and could be instantly fixed by freezing, it was decided to study some gemistocytic astrocytomas in respect of their acid phosphatase ($\alpha + \beta$ glycerophosphate substrate) and adenosinetriphosphatase activity.

MATERIAL AND METHODS

The material studied was from a series of operations on astrocytomas carried out in the Guy's Hospital Maudsley Hospital Neurosurgical Unit. During a craniotomy a small portable refrigerating apparatus was kept in readiness in the annexe to the surgical theatre. This apparatus was made up of a 2 litre dewar flask containing acetone brought down to below -65°C by the addition of small pieces of CO_2 ice. A pyrex glass tube 15×3 cm. containing isopentane to about two-thirds of its length was placed in the cooled acetone. A thermometer (Rototherm) was left in the pentane and when the reading was below -65°C the freezing mixture was ready for use.

A small chemically clean porcelain tile $15 \text{ cm} \times 15 \text{ cm.}$, a clean razor blade, a spatula and fine forceps were kept at hand. Immediately the surgeon removed the specimen it was dropped on to the tile. The forceps were used to steady the material and the razor blade to make 2 mm. thick slices. The slices were then slid onto the spatula which was held over the pentane. Each slice was then moved off the spatula so that it fell as a small disc or square into the frozen pentane. An adjacent block of similar proportions was placed in 10 % formalin and a third in formal-ammonium-bromide.

The frozen material was now rapidly transferred to a previously cooled pyrex glass tube 15×3 cm. containing a 2 cm. deep layer of paraffin wax. The tube was then rapidly attached by a B 34 ground glass joint to a wide bore glass adaptor leading via a rubber diaphragm-type isolation valve to the P_2O_5 trap of an Edwards 2550 mechanical vacuum pump with a non-return valve. The tissue carrying tube was immersed in a refrigerating mixture of phenyl-ethyl-ether and CO_2 ice. The pump was started and the temperature of the surrounding phenyl-ethyl-ether bath was allowed to rise to -30°C (the m.p. of phenyl-ethyl-ether). The bath was maintained at this temperature by small additions of CO_2 ice for 72 hours.

A measure of the rate of water evolution from the tissue was obtained by closing the isolation valve and recording the rate of pressure change by a Pirani type vacuum gauge attached to a glass adaptor. The final vacuum reached was usually less than 10^{-2} mm. Hg and the rate of pressure rose less than 10^{-2} mm. Hg/min. at -30°C . After usually 72 hours or when the tissue was judged to be sufficiently dry the vacuum flask containing the refrigerant was removed. After usually a further 30 minutes of drying or after a satisfactory test for the adequacy of drying, the isolation valve was closed and the pump stopped. The layer of paraffin wax on which the tissue rested was now cautiously melted by placing around it a warm water bath, after admitting a little dry air into the tube through the P_2O_5 to prevent boiling of the wax at too high a vacuum. When the wax was molten the pressure was alternatively lowered and raised a few times so that good infiltration of the tissue with wax could be secured in about 20 min. at 52 – 65°C . Paraffin blocks were made and cut at 10μ thick. These sections were mounted dry on albuminised glass slides and placed soon after in a dessicator over anhydrous silica gel for later use.

Prior to the chemical processing the sections were placed in an incubator for 30 minutes at 37°C . This improved the quality of the dry mounting without affecting enzyme activity. The sections were dewaxed by treatment with light petroleum (b.p. 100° – 120°) for 1 minute followed by petroleum of boiling point 60° – 80°C . for 1 minute and finally in isopentane for 0.5 minute. The last solvent evaporated almost at once after removal of the section from the jar, and was

immediately thrust with a sharp movement of the fingers into the incubating medium to avoid the adherence on the surface of air bubbles. The principle of the subsequent procedure is that of Gomori and of Takamatzu. The enzyme in the tissue sections was allowed to hydrolyse a single phosphoric acid ester, with which was incorporated a lead salt on the hydrolysis of the substrate the liberated phosphate was precipitated at the site of action as lead phosphate. The colourless lead salt was then converted to lead sulphide and the preparation was studied microscopically.

All the materials used in the incubation media were treated to remove impurities. Inorganic phosphate and traces of heavy metals were removed from adenosine triphosphate (A.T.P. Boots dibarium salt) as follows, at 0°. A sample (1 g.) was dissolved in 2 N HCl (15 ml) and water (20 ml) was added. After the addition of M barium acetate (2 ml) sufficient 5 N NaOH was added to bring the pH to 4.7-4.9. The precipitate was separated by centrifugation, washed three times with a little water and redissolved in 2 N HCl (10 ml) and water (15 ml). After passing H₂S, a slight excess of 0.2 M Na₂SO₄ was added. After centrifugation and filtration, air was blown through the supernatant to remove excess H₂S, the solution neutralised with N NaOH and water added to give 0.01 M solution on the basis of acid labile phosphate. All reagents even if described as of analytical grade were redistilled, recrystallised or reprecipitated as appropriate, and stock solutions of substrates stored at -78° C.

TABLE 1

Glycerophosphate medium pH 5.3	
0.1 M sodium acetate buffer (pH 5.3)	15.0 ml
0.04 M lead acetate (neutral)	1.5 ml
0.1 M stock solution glycerophosphate	1.5 ml
0.1 M magnesium chloride	1.0 ml
glass distilled water to	30.0 ml
Adenosine triphosphate medium pH 6.5	
0.002 M stock solution adenosine triphosphate	7.5 ml
0.01 M sodium succinate buffer (pH 6.5)	15.0 ml
0.04 M lead acetate (neutral)	0.75 ml
glass distilled water to	30.0 ml

Incubation periods at 37° C covered a wide range of times. Sections were removed at intervals, usually forming a logarithmic series: 10, 20, 40, 80 minutes. When the sections were removed after various intervals they were washed for 10 minutes in four changes of ice cold distilled water, placed in cold dilute yellow ammonium sulphide (1 ml in 50 ml water) for two minutes and rinsed again in iced distilled water. The sections were rapidly dehydrated through the alcohols followed by 15 % cyclohexanol and petroleum ether. They were mounted in "clearax" (Gurr) dissolved in petroleum ether.

Control of the tissue activity in the two media was obtained by the omission of the phosphoric acid ester, by washing or heating the tissue, by chemical pre-treatment with trichloroacetic acid and especially by the use of enzyme inhibitors acting at relatively low concentrations. Sodium fluoride (10⁻³ M) was used to control media with glycerophosphate and orange acetate (10⁻³ M) in adenosine triphosphate control media. Complete suppression of the enzyme activity was possible with the concentrations of inhibitor stated above.

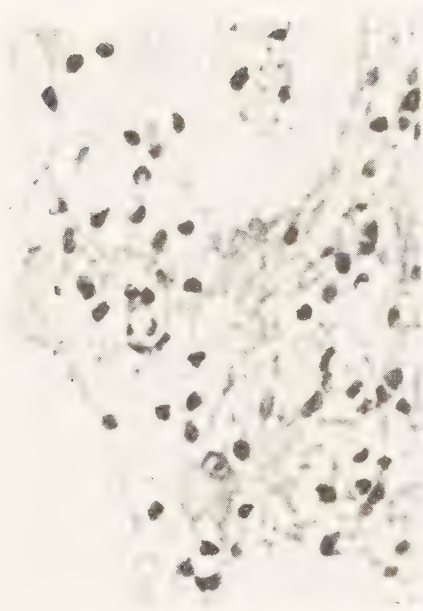


Fig. 1.

Haematoxylin and eosin shows that the tumour is a gemistocytic astrocytoma. $\times 320$.

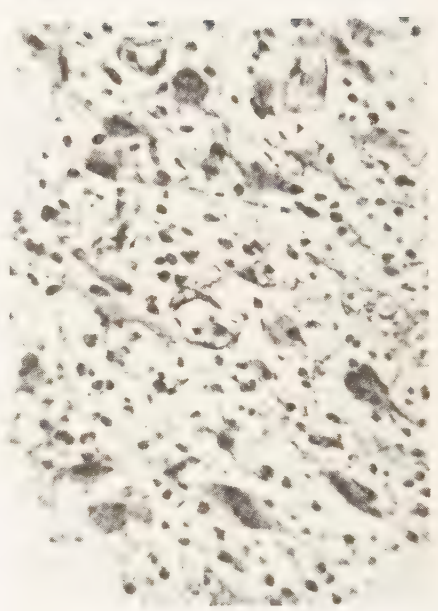


Fig. 2.

Lithium silver carbonate. Confirms the diagnosis made from Fig. 1 and shows several gemistocytes. $\times 320$.

The formalin fixed material was used to prepare haematoxylin-eosin sections and the formal-ammonium-bromide fixed material was used for the silver preparations.

Presumably normal cerebral tissue overlying the astrocytomas was also processed in order to compare the enzyme activity of the normal human astrocyte with the tumour cell.

Eight gemistocytic astrocytomas were studied and each was submitted to the identical procedure by the same technical assistant.

RESULTS

The haematoxylin and eosin preparations of each of the eight cases confirmed that the material being dealt with was from gemistocytic astrocytomata. The first figure illustrates the histological results obtained in the third case. It shows a typical gemistocyte situated in the lower third of the figure (Fig. 1). The silver preparation (Fig. 2) is a lithium silver carbonate picture which shows the two types of cell comprising the tumour very well. There are several typical gemistocytes, and here and there fine fibrils and fibrillar structures are seen. The hydrolysis of glycerophosphate at pH 5.3 and at an incubation period of 40 minutes is illustrated in Fig. 3. This figure demonstrates the intense enzyme activity occurring in the gemistocytes as well as



Fig. 3.

Glycerophosphate substrate pH 5.3 showing intense enzymatic activity in cytoplasm of gemistocytes as well as in the smaller astrocytes. The cell elements appear larger than in Fig. 1 and 2 at the same magnification, but this is due to shrinkage resulting from standard histological procedures.

× 320.

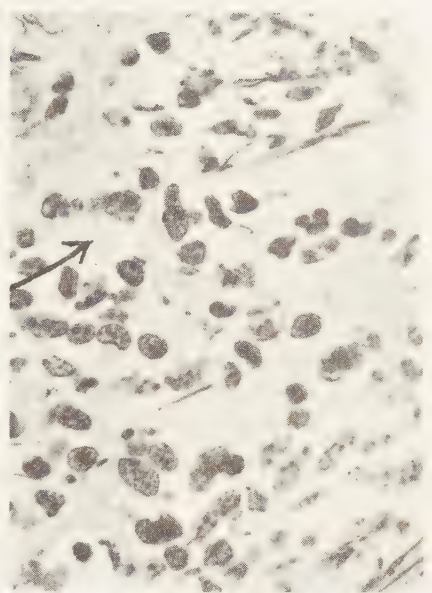


Fig. 4.

Adenosine triphosphate substrate pH 6.5 showing activity only in the nuclei and the cytoplasm of the gemistocyte (arrow) is clearly demonstrable as inactive. As in Fig. 3 there is no cell shrinkage due to fixation and chemical dehydration. × 320.

in the smaller astrocytes. Not only does the nucleus of the gemistocyte show activity, but the cytoplasm shows equally strong hydrolytic activity. Further, numerous coarse fibres are seen throughout the field, and some appear to be arising directly from the gemistocytes. The strands of fibre can usually be followed under the microscope to a cell of origin and do not appear to be due to protein condensation occurring in the process of freeze drying. The fibres show considerable variability in enzyme activity and the shorter thick fibres apparently deriving from the gemistocytes show the greatest activity. Increasing the incubation time does not materially alter the picture, whereas reducing the incubation time progressively shows up only the sites of the highest enzyme activity, so that at incubation periods of 10-15 mins. only the nuclei stain very darkly and the cytoplasm of the gemistocytes stain a little less darkly. Fibres do not appear at these short periods. The sites of hydrolysis of adenosine triphosphate at pH 6.5 are illustrated in

Fig. 4. Unlike the sites of activity shown in Fig. 3 hydrolytic activity is restricted only to the cell nuclei. This picture appears after an incubation period of 40 minutes and varying the period does not alter the distribution of activity. At very short incubation periods nuclei are seen faintly stained and at longer incubation periods they are very darkly stained, but some background staining appears as well. The illustration shows clearly that many gemistocytes are present in the field but that the cytoplasm remains quite unstained (arrow). One feature of the distribution of the hydrolytic activity to adenosine triphosphate is that throughout the microscopic field numerous small astrocytes are seen whose nucleolus only stains.

Although case 3 is illustrated here the other seven cases examined show almost identical results.

DISCUSSION

Many of the difficulties arising in both the freeze drying and enzymological technique were taken into account when the study was made. Control of the tissue activity in various media was obtained by the omission of the phosphoric acid ester, by washing or heating the tissue, and by chemical pre-treatment with trichloroacetic acid. The use of enzyme inhibitors acting at relatively low concentrations was given a special place in the control procedures. If the ester were omitted from the substrate medium, the staining was negligible in quantity and amorphous in appearance and had no cytological characteristics. Complete suppression of staining could be produced by adding to the substrate medium selected inhibitors. Sodium fluoride (10^{-3}M) was used in the control media with glycerophosphate, and uranyl acetate (10^{-3}M) in the adenosine triphosphate control media. The medium containing glycerophosphate was substantially the same as that described by Gomori. The other medium was found experimentally to provide optimal conditions for qualitatively different staining in the minimum time. Inconsistent results were obtained when the adenosine triphosphate used in the incubation medium had not been reprecipitated but consistent results were obtained in each case when impurities were removed from the commercial sample of adenosine triphosphate. Variation of the pH level of the substrate media within the acid range did not alter the characteristics of the localisation but retarded the rate of the reaction. The short incubation times and the unfixed frozen dried tissue employed made possible by preserving enzyme activity the reduction of artefacts due to possible diffusion and fixation to a minimum. Although The striking differences in the distribution of

enzyme activity seen at short incubation times is no longer present when very long incubation periods are used; it is clear that the maximum effect of purely enzyme activity is obtained at the shorter incubation periods. Since frozen dried brain tissue retains an enzyme activity of the same order as that of homogenized tissue used for biochemical investigations, it is likely that most of the enzyme activity as obtained in histochemical procedures with unfixed tissue is obtainable in the first 30-40 minutes.

The enzymological activity of astrocytomatous cells has not been previously studied in material unaltered by preparatory chemical fixation. Comparisons therefore between histochemical results in unfixed nervous tissue incubated for short periods and in fixed nervous tissue incubated for much longer periods do not appear useful. Findings for the normal rat cerebral cortex have shown that astrocytes hydrolyse glycerophosphate only to a moderate extent and nowhere in the brain does the degree of hydrolysis as assessed by microscopical examination approach that of the neuron for the same substrate. In the astrocytoma the degree of hydrolytic activity for glycerophosphate is very high. The findings for astrocytes in apparently normal brain tissue overlying the astrocytomas, which form the subject of this study, showed an enzyme activity less than that of the tumour cell for the same substrate. In formalin fixed material these astrocytes appeared normal in every way, but it is possible to hold that since they overlay tumour tissue they may have been biochemically slightly abnormal. Until undisputably normal brain tissue is obtained under conditions suitable for freeze drying, the enzymological behaviour of the normal astrocyte cannot be studied with sufficient accuracy in man. Compared, however, with the activity of the normal astrocyte in the experimental animal and of brain tissue excised by the surgeon while approaching a neoplasm the astrocytomatous cell shows much greater glycerophosphatase activity and less adenosine triphosphate activity. Yao has shown that the presence of increased glycerophosphatase is associated with cell degeneration and Bodian and Mellors have demonstrated that the maximal concentration of acid glycerophosphatase correlates with the early repair phase in nerve fibre regeneration. Further, the hydrolysis of adenosine triphosphate is an energy-yielding processes and this compound undoubtedly plays a major role both in normal brain metabolism and in tumour cell metabolism. These results indicate that the histochemical study of frozen dried brain tumour material may provide detailed information on a cytological level of varying metabolic patterns which cannot be obtained by examining suspensions of tumour by the normal biochemical procedures.

SUMMARY

Gemistocytic astrocytomas obtained at operation and immediately frozen dried have been examined histochemically with respect to their hydrolytic properties for the substrates adenosine triphosphate and glycerophosphate in the acid range. The results show that the gemistocytes as well as the smaller astrocytes of the tumour show intense activity in the glycerophosphate substrate and that the nuclei as well as the cytoplasm show equally strong activity. Numerous coarse thick fibres arising from the gemistocytes and not usually seen in the ordinary histological preparations were present and showed a moderate degree of enzyme activity to the glycerophosphate substrate at pH 5.3. In the adenosine triphosphate substrate at pH 6.5 only nuclei show hydrolytic activity and the cytoplasm of the gemistocyte is clearly demonstrable as inactive. Although many of the smaller astrocytes show strong nuclear activity, some show only nucleoli.

The validity and significance of these results is discussed.

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A DISCUSSION OF THE BASIC PRINCIPLES OF THE PSYCHOANALYTICALLY ORIENTED PSYCHOTHERAPY OF SCHIZOPHRENIA

By

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At approximately the same time, towards the close of the nineteenth century, two basically different approaches, both of great importance, were introduced into psychiatry: *Kraepelin's* and *Freud's*. With regard to schizophrenia, *Kraepelin's* descriptive, phenomenologically founded nosology particularly laid stress on the symptom of progressive deterioration. Accordingly, an underlying organic process was presumed—chronic, capable of temporary remissions, but relentless in its final course. Consequently, the view of therapeutic possibilities, including psychotherapy, was nihilistic.

Applying his dynamic-psychological approach to schizophrenia, *Freud* made valuable contributions towards the understanding of schizophrenic contents and dynamisms. Nevertheless he held a similar pessimistic view with regard to therapy, as did *Kraepelin*. Particularly, he considered as a principal factor in schizophrenia a regression to such a level of narcissism that a workable transference relationship could not be established.

However, already early in the second decade of this century more optimistic voices were heard. *Bleuler* and *Federn* stated that the course of the illness could be greatly and favourably influenced by psychotherapy, and *Bjerre* (2) reported a case of paranoia cured by psychoanalysis. But it was not till the development of the ego psychology was well advanced, and particularly during the two last decades, that treatment of schizophrenia gained a more wide-spread interest among analytically trained therapists. The names of *Bak*, *Eissler*, *Federn*, *Fromm-Reichmann*, *Knight*, *Rosen*, *Sechehaye*, *Sullivan*, *Wexler*, and

¹ Read to a meeting of Svenska Psykoanalytiska Föreningen (The Swedish Psychoanalytic Society) in the Spring of 1952.

*Zilboorg*² are to be found foremost among those who have contributed to this development by publishing their clinical experiences on the subject.

After the perusal of their papers one is left with several general impressions. First: while a good deal is said about the treatment of the manifest psychotic phase, not very much is said about the latent phase. Not that the latent phase has been neglected by the investigators in their clinical work; that is readily seen, but a reluctance with regard to the rendering of concrete, clinical material or formulations of general principles is equally apparent.

Second: while there is unanimous agreement that psychotherapy is effective in schizophrenia, there is considerable uncertainty as to the prospect of a definite, final cure.

Next, while no trace of doubt is left that schizophrenic patients in the most severely disturbed states, even of long duration, can be brought out of these states by psychotherapy based on analytic understanding, it is equally striking that the techniques employed vary over a wide range, with *Federn's* recommendations at one end of the scale and *Wexler's* and *Rosen's* at the other.

Furthermore, it is remarkable how much attention is given to the problem of the personal qualifications of the therapist. In general counter-transference problems are the focus of intense scrutiny at the present time. Their great importance in the analysis of neurotics is sufficiently established. However, it is being stressed over and over again that in the treatment of schizophrenics the problem of the personal requirements of the therapist is an even more precarious one.

Faced with the gamut of varying and partly contradictory treatment recommendations it seems at once a confusing task to attempt a survey. Obviously the field is governed entirely by empiricism and experimentation and no generally accepted rationale exists. It may, therefore, prove useful to attack the problem in a practical manner and take as the point of departure a clinical example which, besides being presented in great detail and with admirable simplicity and clarity by its author, *Robert P. Knight*, represents an approach, situated, as it were, "in the middle" (15).

The patient was a boy aged seventeen from a well-to-do, cultured family; his parents were kind and congenial, and the members of the family were living on good terms with one another. He had always been a "good" boy, extremely considerate of others, more so than usual in adolescent boys, and conscientious with

¹ No comprehensive survey of the literature will be attempted. I am going to deal with those papers only which seem to me particularly pertinent to the discussion of the basic principles of the psychotherapy of schizophrenia.

his school work. He would often help the coloured cook with her kitchen work. He was reserved towards girls, always at dances looking for those who otherwise were not asked to dance. Although he did not betray it at the time, he was disturbed by the sexual talk of his pals, and he did not participate much in the camaraderie of the boys; nevertheless, he was popular among them. The only criticism stated against him was that he was rather slow in getting things done and somewhat inclined to procrastination.

His illness developed rapidly within the last two months prior to his admission to the sanitarium. Together with his mother he had been in another city to visit his elder sister, who was married, and her newborn baby. During this visit he seemed to be more withdrawn than usual. After his return home his withdrawal grew more and more pronounced, he repeatedly disappeared for several hours at a time without explanation, once for instance he vanished from a dinner party in his own home. He became excessively slow about simple tasks such as dressing, undressing, etc. At times he would stand gazing into space, indoors or in the yard, interrupting his occupation at the time. If anyone praised him for his work, he would immediately stop it and remain motionless. A week before his admission when returning from a drive with his mother he saw a car in front of the house and thought it belonged to his unmarried sister's boy friend. He refused to leave the car and enter the house and his behaviour rapidly became more abnormal. He almost ceased eating and for long periods at a time he would stand in awkward positions.

In the sanitarium he would stand for hours in rigid postures, sometimes with his eyes tightly shut, his fingers stuck in his ears, and his jaws set. Mostly he was completely mute. He refused to take any food and had to be tube-fed. His ankles and feet became quite swollen. If anyone tried to make him move, he would resist actively, scowling at the person who was interfering with him. Neither hallucinations nor delusions were observed. In sodium amytal interviews his behaviour did not change at all.

After the patient had remained for 3 weeks in the catatonic state described above, *Knight* commenced on psychotherapy with him, one hour per day. *Knight* states (and he considers this to be important) that from the first moment he considered the patient to be a worth-while, likeable boy, whom he felt convinced he could help. His initial approach, which remained the basic one throughout the treatment, was one of displaying affection and understanding without being intrusive. Yet he was insistent in talking to the patient, slowly, quietly, with pauses between the sentences, avoiding to look steadily at him, and often speaking casually. Frequently *Knight* used information from the case history in order to show his understanding of the events which had led to the patient's admission to the hospital. At the same time he reassured the patient that he had come to help him and that he had been able to help other boys like the patient. He told the patient that he knew he was having a severe struggle within himself, and was trying to solve his problems for himself, but that he needed someone to help him out. *Knight* also explained how, when he himself was of the patient's age, he had experienced some of the turmoil the patient was in now. While *Knight* was talking like this the patient would remain standing in awkward, uncomfortable, rigid postures, apparently without taking any notice. He would only rarely respond by a single word, or a slight nod, or sometimes he would seem to listen for a short while. On one occasion, when *Knight* mentioned the patient's father, the boy's eyes filled with tears.

After a few days *Knight* began in a gentle way to interpret the patient's resistiveness, his facial expression when interfered with, and his refusal of food as signs of anger and defiance. The patient shook his head, but after a little while he asked quickly: "Would you help anybody, no matter how mean they were?" The answer was in the affirmative. A couple of days later when he was found sitting in an "on guard" boxer's position the patient was told that he was fighting another part of himself. Following this he relaxed to a certain degree. Again and again his defiance and resentment were pointed out to him in a gentle, accepting, and reassuring manner, and gradually he became more and more accessible. After several weeks it was possible to penetrate his autism in 15-20 min.s and he would listen for the rest of the hour, even answering now and again. During this period he sometimes bit his lips severely and on one occasion he held his foot against a hot radiator for so long that he was severely burnt. After five weeks he suddenly one day beat up another schizophrenic patient whose provoking jeers he had endured in silence for several days. In spite of the fact that he was praised for his justified aggression, he again relapsed into rigid, staring catatonia following this incident, his lip-biting increased and for some time he was still more inaccessible.

After six weeks of psychotherapy a kind of turning point occurred when one day *Knight* asked the patient whether he felt any resentment against his father for having brought him to the hospital. The patient denied this, saying that in fact he could not feel any resentment against his father. He also said that the nurses and attendants were treating him too kindly for him to respect them. Their kindness only impeded him in his thinking, and caused him to drift off and "become a mental patient". He further stated that he could not respect his father either. Following this he sank into a very marked catatonic posture with staring eyes.

The next day he was standing rigidly in the bathroom and refused to enter his room, but he was obviously alert to the way *Knight* would react to this. After a vain attempt at persuasion *Knight* took firmly hold of him and propelled him into his room. He explained to the patient that his defiant negativism was a swing of the pendulum to the other extreme from his previous over-compliance, politeness, and consideration of others. Using his knowledge of the father's non-authoritarian attitude to the boy, *Knight* then went on to point out how the fact that his father had been treating him "too nicely" in a "man-to-man" way had caused him to become afraid of his own impulses and also to lose respect for his father as a disciplinarian. Further, *Knight* told the patient that from now on the doctors and nurses were to insist upon his personal care and that he would be made to do the things that had to be done. On the same day the orders to the nurses and therapists were changed, they were instructed to use firmness and insistence rather than coaxing and to withhold praise for routine obedience and minimal achievements. The patient was told of this change in attitude. From then on the patient improved, although his progress was quite uneven.

During the continued treatment *Knight* maintained this firm attitude; he also interfered with the patient's defensive attempts to escape into a dreaming catatonic state when painful topics were mentioned, and *Knight* refused to accept evasive statements from the patient such as his "not being able to think and talk at the same time" or "not being able to think of two things at once." Also, the patient's inclination to escape from what was specific and concrete into the general and abstract was curbed. Simultaneously with this firm attitude the basic attitude all the time remained one of affection, empathy, understanding, and never failing

interest. *Knight* would always shake hands with the patient when he left, often he would put an arm around the patient's shoulder and occasionally he would run his fingers through the patient's hair. Fairly often *Knight* told about certain aspects of his own adolescence which pertained to the patient's problems.

At a time when he was otherwise in good progress and taking walks on the hospital grounds, the patient had a sudden and complete relapse into catatonia, autism, and severe lip-biting. This followed immediately upon his father's first visit during which the patient had conversed willingly on impersonal topics, to the father's immense satisfaction. He himself, however, felt that he had shown an insincere attitude towards his father. It took some weeks before he again progressed.

I shall stop here, and only mention that after three months the patient started going to *Knight's* office for the sessions; after fifteen months he became an out-patient and began taking courses at the local University; from the nineteenth to the thirtieth month he was seen only once a week or even less frequently and finally he was discharged. He entered the navy and served eighteen months with excellent performance and then reentered college to complete his studies. He became well adjusted to his family and friends, and had many dates with various girls, but he still found it difficult to proceed beyond a casual, platonic relationship with them.

Recently Dr. *Knight* informed me that the patient has been well for ten years, he took his master's degree, has been married for the last 2 or 3 years and has needed no psychiatric care since the time of the above treatment.

"Psychotherapy of an Adolescent Catatonic Schizophrenic with Mutism."

Rob. P. Knight.

Psychiatry. 9, 323, 1946.

I have selected this report for the following reasons: The typical history and classic Kraepelinian symptomatology leave no doubt regarding the diagnosis, acute schizophrenia of the catatonic type. The central psychological problem stands out in relief. Phases of improvement and relapse alternate quite frequently in understandable relation to the therapeutic measures or other events in the patient's daily life. The outcome seems to justify the assumption that the psychotherapy that was concluded ten years ago was decisive of the patient's improvement and lasting social readjustment.

The principal difficulty when first approaching a schizophrenic patient with therapeutic intentions is that of obtaining contact with him. The tool used by *Knight* for this purpose is obvious: in a gentle but insistent manner he demonstrated to the patient in attitude, words, and gestures his liking for him, his acceptance and his wish to help. Along with other attitudes, later introduced into the treatment, this remained the basic climate of the therapeutic situation and *Knight* regards the attainment and the maintenance of an affectionate relationship as a therapeutic agent in itself.

Everybody familiar with the development of the treatment of

schizophrenia will know that throughout a long period of time "tender, loving care" was considered the main characteristic of a proper approach to schizophrenics. *Federn* (6, 7, 8) considered the fostering of love and affection in the therapeutic relationship as the method of choice to such a degree that he warned against any interpretation of expressions of hostility. If a patient's hostile feelings could not be dissolved through the therapist's kindness, the patient should preferably be transferred to another psychiatrist; or *Federn* would stop seeing the patient and continue to direct the treatment through some female attendant of a warm, motherly type, towards whom the patient would have only friendly feelings.

Eissler (5) reports how in his treatment of acute cases of schizophrenia in the army during World War II he utilized an affectionate approach. "A maximum mobilization of the patient's responsiveness by supplying maximum affection through those channels which were still open, had a therapeutic effect on the acute phase of schizophrenia." His technique was "rather simple, not to say primitive." The content of his conversations with the patients he considers as irrelevant. He states that the patients reacted to his affects and emotions. Particularly the quality and timbre of his voice seemed important, and so were his gestures and his ability to listen in the way which, without words, conveyed his understanding to the patient. Successful administration of the feeding situation was extremely useful with patients who refused intake of food. "—When spoon feeding, administered with tenderness, affection, and loving (but not patient) persuasion succeeded, the patient usually showed during the meal or shortly thereafter a definite tendency towards improvement."

Eissler is unable to give any figures regarding his results in the army, but he states that in few cases did he fail to bring the patients from the acute phase into a state which permitted the patients to be discharged and sent home. He stresses of course that it was not a question of cure, but of discontinuation of the acute phase, and he believes that a number of his patients must have relapsed after their return home.

In *Rosen's* and *Sechehaye's* works to be reviewed in more detail below the supplying of gross amounts of affection and love plays a paramount rôle.

Although offering of friendship and display of affection on the part of the therapist is not considered expedient by all authors, as will be demonstrated below, it cannot be denied that the attitude in question is symptomatically effective in the treatment of the acute phase. One is struck with amazement, as is *Eissler* himself, that such a primitive

remedy can be productive of such striking alterations in the clinical status of the patients.

Eissler (5) subjects the phenomenon to a detailed discussion. He points out that the fact that the patient who is inaccessible to a rational discussion, may be relatively inclined to respond to the therapist's emotions, reminds us of the subdivision of mental phenomena into those which are closer to the primary process and those which are subjected to the secondary process¹. Furthermore, he stresses that the histories of schizophrenic patients are rich in pathogenic experiences occurring at a time when the patients were subjected to primary process manifestations in their environment. As is well-known, paranoiacs are highly responsive to primary process manifestations in others like coughing, spitting, scratching, or other involuntary activities. Equally, the paranoid person seldom projects into the sky, but lets himself be guided by some, often unconscious, primary process manifestation going on in somebody in his environment. *Eissler's* conclusion is that the schizophrenic patient, being himself under the domination of the primary process, is unable to react to the secondary process manifestations in his environment which are meaningless to him. Now, the more affect, emotion, or passion there is in a psychic process, the closer it is to the primary process. In case, then, the therapist succeeds in addressing himself to the patient by way of an emotion which fits in with the patient's needs in the realm of the primary process, the patient will get the same experience as a person who, having felt himself hopelessly isolated among people speaking a language foreign to him, hears himself addressed in his native tongue. When this happens, the therapist will, if only fleetingly, appear to the patient as a real person, well differentiated from the rest of the world of which the patient is oblivious. Expressed in more theoretical terms, a perception of an object can be vested with libido, in a narcissistic way, to be sure, but an object representation is established which is cathected and, therefore, differentiated from the self. Thus, the self is again separated from a part of the outside world. Once this process has taken place, there will be a tendency towards repetition of the process, involving more and more objects. At this point the patient's withdrawal is broken through.

This way of viewing the problem is perhaps not essentially an entirely new one, but *Eissler's* formulations stand out by their explicitness and clarity. He states himself that his explanation is probably a simplified one, but that it indicates the direction in which we ought to look. I think myself that he makes an important point.

The object relationship to be established for the patient must necessarily be a narcissistic one. In general the schizophrenic is not re-

¹ The *primary process* may be defined as the tendency towards immediate, unconditional discharge of drive energy.

The *secondary process* may be defined as the tendency towards binding, inhibition and control of drive energy.

But as *Eissler* puts it: "Psychic processes with few exceptions are never purely primary or secondary. They are usually closer to one or the other. The more of affect, emotion or passion there is in a psychic process, the closer it is to the primary process. The more it is the product of rational, logical, correct thinking, the closer it is to the secondary process."

garded as capable of any other form of relationship, something which is for instance stated by *Bak* (1), is implied in *Eissler's* paper (5) and in *Knight's* (15). Knight says that "The patient can best make contact with somebody he is able to feel is like or has been like or could be like himself." *Sechehaye* (19) gives a good illustration of this kind of narcissistic object choice. Speaking of her patient Renée she tells:

"Whenever Renée took a walk with someone for whom she had no esteem, she would not keep step with that person, so as not to become like that individual. But if Renée found herself with a person endowed with a quality which she herself would have liked to have, she would immediately fall into step the moment the quality appeared (by gesture or word)——."

This kind of relationship, based on fusion and identification with the object should not be named by the term transference. When working along the lines, we are dealing with here, the therapist does not aim at creating a transference relationship. His goal will be to establish a relationship which preferably the patient as far as possible experiences as a reality, and which, contrary to the attitude towards neurotics, gives him good reason to feel himself liked by the therapist.

Therefore, it goes without saying that the emotional approach to the patient must be one which does not arouse his anxiety, mobilize his defences or cause him to intensify his withdrawal. Therefore, the extension of gentleness, love, and affection might seem the only appropriate attitude. We shall return to this point.

As briefly mentioned above, not everybody agrees with this affectionate approach to the patient. *Hanna Segal* (20) explicitly states: "I took care not to step out of the rôle of the analyst who interprets, into that of an ally or an educator." However, the author who cautions with most authority against offering friendship and affection to the patient is *Frieda Fromm-Reichmann*. Particularly in her last papers she is quite vehement (13).

"Trying to initiate or facilitate treatment of a schizophrenic by making friends with him, or by other attempts at turning a strictly professional relationship into a pseudosocial one, may, according to our experience, turn into a serious threat to successful psychotherapeutic procedure." (13) The dangers are, she thinks, mainly the following: (a) Too much friendliness frequently clashes with the psychotic's marked fear of closeness, particularly because the schizophrenic will fear that the psychiatrist will later disappoint him; also the schizophrenic will be reluctant to disclose his "meanness", "ugliness" and hostility for fear this will cause the psychiatrist to withdraw his friendship again. (b) "Closeness increases the schizophrenic's ever-existing fear of losing his identity, of losing the sense of boundaries between himself and the outside world" (13). (c) It hurts the self-esteem of the patient to display the hostility and meanness which he condemns himself, towards

a person with whom he feels connected in closeness and friendship. (d) The hypersensitivity of the schizophrenic makes him able to spot any trace of insincerity in an affectionate approach.

Quite aggressively *Fromm-Reichmann* turns towards those who think differently: The psychoanalyst, she says, who feels the temptation to try to reach a very disturbed psychotic schizophrenic by offering closeness, friendship, or love, should ask himself whether he may not be motivated by his own anxiety, stirred up by the patient's condition, rather than by an alleged concern for the patient's welfare (13).

Her main approach is just opposite to the emotional one: "In our therapeutic endeavors we try to address ourselves, if it is at all feasible, to the adult part of the patient's personality, regardless of how disturbed he is—," so she says (13).

All of the objections enumerated above concern important factors in the treatment of schizophrenics and they are to be borne clearly in mind. However, they seem to me to be presented by *Fromm-Reichmann* with an impetus out of proportion to their conclusiveness for the subject under discussion. Surely, the therapist may adopt an affectionate attitude in order to relieve his own fear of the patient or the anxiety stirred up in him by the patient's material. And certainly, the patient may be afraid of the risk of disappointment, of being rejected if he shows himself as he is, of losing his identity, or of losing self esteem. And every one of these possibilities is obvious a pitfall to those who, for lack of knowledge, training, or personal qualifications, are not up to the difficult task of treating schizophrenics. Or the propensities of the patient in one of these directions can be such an obstacle that even the skilled therapist fails. But to my mind all these objections are possible complications to be aware of, not contra-indications.

Besides, it does not seem convincing that in general it should be possible to reach disturbed schizophrenic patients by mainly addressing oneself to the "adult part" of their personality.

However, *Fromm-Reichmann's* last point (d) deserves special attention. Also *Freud, Knight, Eissler* (in a detailed discussion (5)), *Rosen, Sechehaye* stress the peculiar ability of the schizophrenic to sense what is going on in other people's conscious, as well as unconscious, minds. Therefore, unrestricted honesty and openness is generally recommended with psychotics. This does not mean, of course, that it is not permissible to refuse to tell a psychotic patient something, but you have to tell him explicitly that you will deny him the information he is asking for. And it is preferable to tell why. With regard to one's behaviour towards the patient one cannot hide anything. Particular it is necessary

to be able to admit one's mistakes frankly. But it is of still greater importance in the present context that it is impossible and, therefore, even in spite of the best of intentions, highly objectionable to try to belie the patient with regard to one's emotions towards him. Consequently it is not feasible to pretend more than one feels, and *Fromm-Reichmann* is right when she claims that an affectionate approach which is not what it pretends to be, is detrimental to the relationship with the patient. In this connection it is worth while noticing that *Knight* definitely stresses that he found his patient "a worth-while, likeable boy" and the narrative of the case, simple and unsentimental as it is, conveys to the reader the impression of a strong sympathy on *Knight's* part. *Eissler* (5) reports that he was most successful when he felt fascinated by the patient and in particular when he felt moved by the patient. In a footnote he tells that his patients reactivated in him a rescue phantasy of early childhood. On the single occasion when I saw *Rosen* work, I received the impression that his intense emotional approach to the patient was sincere with no show about it or sign of sentimentality in it.

Now, it cannot be sufficiently emphasized that supplying affection must not be done indiscriminately. Both timing, manner, and degree must be carefully checked and controlled, particularly because of the frightening effect it may have on some patients to meet expressions of affection or love. Even when affection is mildly and apparently tactfully administered, some patients may feel subjected to a dangerous seduction, exposed to an attempt of rape, or threatened by a danger of being engulfed and losing their identity, as *Fromm-Reichmann* has it.

I can give an illustrating example of such a situation from my own experience. I treated a schizophrenic young woman, who had previously been severely psychotic and in the disturbed ward during hospitalization; at that time she was hallucinated and physically violent. During a considerable period of time I treated her at a very low fee. In spite of my reassurance she was always sorry, she could not pay me a higher fee. One day she noticed the English dictionary I had on my desk and correctly remarked that it was not the best available. She then went on to ask me, would I not permit her to give me a copy of a better dictionary—it was but a rather inexpensive gift and it would give her a feeling of having shown me a sign of her gratitude for the help she received. Her genuine appeal gave me the feeling that it would be an untimely rigid and frustrating attitude to refuse her. So I gave my consent with a certain feeling of warmth for her and she thanked me very much for doing so. The next day she came with the dictionary, being herself in a miserable condition. She told me that while she was in the book store she was trembling, soaked with sweat, and feeling quite unrealistic. During the night she had had diarrhoea, had been anxious and miserable, had slept very poorly. She had dreamt that she was with me, I was very kind to her and then I went into the next room where she could hear me noisily release enormous amounts of intestinal

gas. So, the suspension of my usual principles, meant to be a gesture of affection towards her and carried out with a feeling of affection on my part, turned out to be an anxiety-loaded happening to her, experienced on an anal level.

To find the right balance between spontaneity and controlled, measured administration of feeling is an art. But the difficulty in achieving this goal is no prohibitive fact, as *Fromm-Reichmann* maintains. It is only prohibitive to those who do not master the art, or in cases where the therapist develops no spontaneous warmth towards the patient. As mentioned above, this limits the use of this therapeutic tool.

So far we have dealt only with an emotional approach to the patient, dominated by an affectionate and accepting attitude. *Federn*, as mentioned above, always considered this the only feasible approach. *Knight*, however, as we have seen, soon started to point out the patient's obstinate, hostile behaviour and later, following the patient's communications about his lack of respect for his indulgent father, proceeded to force the patient to submit to the regulations of the interview and the rest of the daily routine. *Eissler* at the time of his experiences in the army displayed only gentleness, affection, and acceptance; later, much to his amazement, he discovered that his progress with a certain schizophrenic patient started when an active measure on a practical level, meant as a help to the patient, had been experienced by her as an act of aggression. *Rosen* (18) reports how, through physically overpowering a patient, he made her quiet down, bettered his contact with her, and initiated an improvement. *Wexler*, however, has given the most comprehensive description of the adoption of a prohibitive, forceful, and at times physically aggressive behaviour towards a patient.

In his paper, (22) published from The Menninger Clinic, *Wexler* tells of a hebephrenic, severely disturbed patient, hospitalized for five years prior to his starting psychotherapy with her. During the first ten months of intensive therapy conducted in accordance with the general principle of affection and acceptance, she showed no improvement at all, "could, on occasion, speak the violent language of a jungle tigress"; and to *Wexler's* "kindliness", and what he "felt to be an affectionate interest in her welfare, she responded mainly with crude sexual overtures or violent rage and overt attack."

One day the patient was talking with strong guilt and self-condemnation about her masturbation, how she hated and despised herself for it. Suddenly *Wexler* decided to agree with her and did so, labeling masturbation as a "terrible, terrible sin." Following this statement the patient was so quiet, agreeable, and relaxed that *Wexler* continued along the same lines, agreeing emphatically with the patient in a repudiation of sex as a whole. For some time in subsequent sessions he consistently took this attitude, even volunteering to pray with the patient that she might get rid of her bad thoughts. When later she herself started to move back

towards a more human attitude towards her own nature, he also cautiously followed her in this. He was struck by the observation that during this period she showed, for the first time, a marked improvement, verbalizing better, taking a more sensible attitude towards her own impulses, and seemingly dealing with reality situations far more effectively than before. He could not help being intrigued by the notion that something in his moralizing, agreeable condemnation of frightening impulses was responsible for the change. Consequently, he further ventured to curb also her aggressive impulses, not only verbally, but, when necessary, immobilizing her with physical force. Occasionally, when she hit him badly enough to make him really angry, he would even hit her back and at times he hit very hard. With but one exception, however, their verbal and physical battles ended with peace-making and affectionate exchanges of devotion. And almost every struggle led to clinical improvement with increased reality testing and diminished anxiety and guilt. Every such improvement was followed by a decrease in the demands upon the patient. After some time the patient's equilibrium would again become to some extent disturbed and the whole procedure would be repeated. The main tendency, however, was one of progress, and at the time of the report the patient was stabilized in a clinically much improved condition.

I can report a similar episode which occurred with the patient of mine mentioned above. Following a disappointment with a boy friend she was seemingly heading for a relapse into a manifest psychotic state. She became quite disturbed, her eyes were wild, she was complaining of all kinds of bizarre and painful sensations, feeling that everything became unreal, people around her were growing beast-like, things like furniture or the door knob seemed to be alive in an uncanny, frightening way. I also became beast-like, weird, and she could not like me as before. Soon she started accusing me bitterly of not loving her enough, not doing enough for her. She could not sit or lie down as usual, but would wander round the office, gesticulating in pain, despair, and anger. She began to scream and would stand in a corner, with her back to me, yelling and scowling at me. All of my usual approaches proved ineffective. Having recently become acquainted with *Wexler's* procedure I decided to try it. Suddenly I changed my attitude from one of empathy to one of forceful, punitive reproach, told her to stop her nonsense which I would stand no longer. I let her know that she had no right or reason to behave towards me like that, that she very well knew I was doing my best to help and that, therefore, she was to behave decently towards me. I spoke very sharply, telling her to stop yelling instantly and to sit down quietly. Obviously taken aback, she did as I ordered, appeared relieved and relaxed, and talked sensibly and composed for the rest of the session. The next morning I had a letter from her, telling me that she felt much better and thanking me because I had taken a firm hand with her. "It was so good that you put your foot down and stopped my silly behaviour. Nothing is worse than when you just sit there and see me go nuts. Then I feel entirely lost." Her state of disturbance had subsided.

Wexler subjects his observations to a theoretical discussion in the light of structural concepts. Briefly, he thinks that because of the impaired ego-functions, the only way of gaining access to the patient is to identify with the patient's archaic and harsh superego. I shall not try to go into this complicated subject in detail. A good discussion of

Wexler's thesis by Robert C. Bak is to be found in the recently published symposium "Psychotherapy with Schizophrenics". (1). I shall, however, try to discuss in general how it is possible to understand that the adoption of an authoritarian, restraining attitude may lead to clinical improvement.

Knight's case serves as a good example. *Knight* knew from the patient's own statements that he regarded himself as a mean person because of his own hostile feelings and that, therefore, he felt severe guilt and self-contempt. Then the patient added the information that he could feel no respect for his father because the latter was too nice and indulgent. Hereupon *Knight* took on a forceful, authoritarian, and restraining attitude towards the patient.

Why did this help? The simplest explanation is that hereby the therapist lent the patient support to control his frightening impulses. *Hartmann, Kris* and *Loewenstein* (14) have exposed in a lucid manner why hostile impulses, met with a passive attitude on the part of the object of the aggression, may give rise to a pathogenic inner conflict. Firstly, in contradistinction to pure libidinal impulses, aggression threatens the object with damage, or, when unrestricted, with destruction. When the object is simultaneously vested with libido, a conflict is unavoidable. Secondly, if in a situation of this kind, aggressive impulses do not meet with any kind of aggressive response from their object, the aggressive individual will be left alone to solve his problem, a state of affairs which will favour one particular solution, namely internalization of the conflict. Thirdly, to have one's aggression elicit no response—or kindness and acceptance—is a frustration which will also stimulate a tendency towards internalization. This internalization may in turn contribute to an increase in feelings of guilt and become related to a rigorous superego or to a masochistic ego.

Now, this was obviously the situation of *Knight's* patient, originating from his relationship to his father. By stepping in and replacing this inner struggle of the patient's with an external one with the therapist, *Knight* relieved the patient of some of his guilt and gave him a possibility for the discharge of some outward aggression, which elicited an appropriate response. This supplied the patient with the experience that he had a strong person on his side in his inner conflict, thus compensating for what he had missed in his father.

This way of viewing the matter is in line with *Wexler's* reasoning about his experiences and it also fits in with the episode with my own patient. Externalization of the inner conflict, help in controlling objectionable inner impulses, and gratification from having aggression meet an appropriate aggressive response are thus the main factors.

I do not, however, think there can be any doubt that the indispensable basis for adopting such attitudes is the preliminary establishment of a dependable relationship of liking and acceptance. This was the case in both *Knight's* and *Wexler's* reports, as it was in my own patient.

One more question remains to be answered. We have tried to account for the fact that an aggressive response in one of its possible variations can cause an immediate relief and decrease of tension in a disturbed patient. But why does it result in an increased reality-testing and in a general improvement? Here we must return to what was said about the affectionate approach. By meeting the patient on a level close to the primary process—albeit now in the realm of aggressiveness—the therapist establishes himself as a real person to the patient. An object representation is caused to be narcissistically cathected. Thereby the therapist constitutes himself as a bridge to reality, furnishing the patient with a nuclear experience around which other object relationships can crystallize.

Thus, we can see the libidinal and the aggressive approach to the patient under a common heading. This is formulated with clarity by Bak (1):

"The failure of reality testing must be due partly to the regression of perception into those phases of development when perceptions were strongly influenced and interwoven with libidinal and aggressive needs. This is partly how we understand the ego being overwhelmed by the drives. In the therapeutic technique we must establish a shift in the energies and further neutralization. One may thus imagine that the therapist, presenting himself as a love object, furnishes libidinal gratification, as a punitive instance draws aggressive energies on himself. *Both* of these may be necessary to liberate the Ego from the flood of drive thus extricating perception from a regressive state."

So far we have been dealing with the therapeutic effect of the therapist's emotional approach. We shall now proceed to discuss those verbal communications which are concerned with interpretation. In this relation schizophrenic productions can be dealt with in terms of content or in terms of dynamics and genetics.

Federn (6, 7, 8) was against using interpretations at all. Since, due to a failure of repression, the schizophrenic's consciousness is flooded with Id-material, he held that the only proper procedure was to use the "positive transference" to effect such regulations of the patient's life which would further re-repression.

On the whole, this point of view has been abandoned. However, there is still serious disagreement as to the category of interpretations to be used.

Fromm-Reichmann, by and large, rejects interpretations of content

in favour of interpretations pertaining to dynamics and genetics. Her point of view is clearly demonstrated by an example which she quotes (11, 12) from a paper by *Stavern*. (21). A patient had the delusion of the appearance of "The Line". She could not tell the therapist what "The Line" was, but with the therapist's cooperation, she succeeded to tell which event preceded every appearance of "The Line". After it had been clearly established what type of events in the patient's life created the appearance of "The Line", it disappeared and the patient improved.

With regard to content interpretations *Fromm-Reichmann* (11, 12, 13) advocates against them, arguing that the patient always knows the meaning of his bizarre productions much better than the therapist. Therefore, interpretations are superfluous, and, if not precise, they are harmful to the doctor-patient relationship. If the therapist understands, he should limit himself to indicate his understanding indirectly by asking pertinent questions.

In accordance with the above-quoted example about "The Line" her recommendations are that the interpretative endeavours be concentrated upon the dynamics in the patient's interpersonal-relationship-difficulties. The pathogenic situations, the basic anxieties, the frightening impulses and the defensive measures employed against them should be pointed out. By extending the exploration along the same lines into the patient's past, he should be made to understand the genetics of his pathogenic conflict. "Eventually, patients should learn to spot their anxieties and to recognize the irrationality of these anxieties by virtue of this therapeutic procedure, and they should learn to understand their pathological manifestations for what they are: manifestations of anxiety and of their attempts to ward it off" (13).

In *Knight's* case you also saw represented a technique mainly concentrated on the dynamics and the genetics in the patient's condition.

Fromm-Reichmann's emphasis on the importance of dynamics is certainly a sound and a valid one. In my own experience I have repeatedly seen how a developing disturbance could be cut short by a correct dynamic interpretation, without paying any attention to the regressive content of the patient's expressions. For instance, on one occasion the schizophrenic patient of mine mentioned before was moving rapidly into a disturbed state; she was not aware that her disturbance originated from the fact that her girl friend, with whom she shared an apartment, had started to have her boy friend sleeping with her during the night. Pointing this out to the patient and causing her to straighten out the matter with the girl friend, who agreed to make other arrangements, balanced her again.

Nevertheless, it is a question whether *Fromm-Reichmann* does not

underrate the therapeutic importance of interpretations of content. Undeniably, the schizophrenic has a vast knowledge of the meaning of Id content in his consciousness, but, as *Hanna Segal* (20) points out, he represses the links between different elements. In particular during the more latent phases it is probably of value to help the patient establish these links by verbal interpretation. In other words, the dissociated Id-elements, dominated by the primary process, may have to be formulated and connected verbally in order to be drawn into the secondary process.

A viewpoint like *Fromm-Reichmann's* is, however, most sharply opposed by the contentions of *Rosen* (16, 17, 18) and *Sechehaye* (19).

To *Rosen* his remarkable and unquestionable success in bringing "deteriorated schizophrenics" out of their severe, manifest psychotic states exclusively depends on his method of "direct psychoanalysis", meaning direct and solid interpretations of the content of the patient's productions, worded in the "fourletter-word language" of the disturbed psychiatric ward. "I was called upon to converse with the patient in the language of the unconscious and to be in the position to interpret the unconscious to him at every single available opportunity. Each symptom, each remark, every symbol must be untwisted, clear down to its earliest ontogenetic and even philogenetic roots in the unconscious" (17).

To give a brief and concise illustration of *Rosen's* method is not easy. I must refer to his papers, particularly the paper from 1947 (17). One cannot imagine any approach more opposite in principle to *Fromm-Reichmann's* than is *Rosen's* not only with regard to the dealings with content, but also with respect to the emotional attitude. *Rosen* does not confine himself to the giving of affection, love, acceptance, reassurance, and protection in verbal terms. He also gives his patients the physical comfort, he thinks they need, taking them in his arms, on his lap, stroking them, kissing, and hugging them on occasions. In his paper from 1947 (17) he reports of 27 successful cases. In all the cases the diagnosis was made by other psychiatrists than himself. The results, too, were confirmed by others, including the editors of *The Psychiatric Quarterly*.

While nobody will—or can—deny *Rosen's* factual results, there is considerable doubt as to the nature of the therapeutic agent in his procedure. His conviction that this agent is identical with his "direct interpretations" is particularly the bone of contention. Sceptical discussions are to be found in *Fromm-Reichmann's* (13) and *Eissler's* (5) papers. *Eissler* claims that the effectiveness does not lie with the correctness of the interpretations measured against the actual material

to which they are applied. With *Fromm-Reichmann* he considers *Rosen's* interpretations arbitrary or incorrect in many instances. He also states that the condition of the patients was often so poor that the patients could not possibly be able to understand any verbal communication like an interpretation. He maintains that the effective agent is *Rosen's* intense emotional approach, also in terms of "friendly aggression". "All the interpretations which *Rosen* gave would have been of no avail if enunciated in a monotonous voice." In accordance with his previously reported views, he thinks that *Rosen* achieves his results by addressing the patients in terms of the primary process. When the contents of the interpretations have any effect, it is not really their interpretative quality which acts; but they serve as expressions in a language which the patient can understand, whether or not they have any bearing on the productions of the patient at the given time.

My own experience does not permit me to try to give any statement of my impressions of a technique like *Rosen's*.

Also *Sechehaye's* technique is based on the most thorough and detailed understanding of the regressive content of the patient's productions, and she regards the intensive utilization of this understanding in a very direct way as the main therapeutic agent.

In her extraordinary and important book (19) she tells of her treatment of a severely disturbed schizophrenic girl. Before, during, and after the treatment the patient was seen by many outstanding psychiatrists. Her procedure must be read about in detail. Using what the patient herself told about the meaning of her symbolisms, *Sechehaye* joined the patient in her symbolic world, as it were, expressing herself to the patient in its language and giving to the patient the greatest possible amount of satisfaction of her regressive needs. This gratification was given on a combined reality- and phantasy-level. For instance, in the very beginning of this treatment by "symbolic realization" the patient ate practically nothing. She would eat only green apples which she herself took directly from the tree. From material which I cannot give here in detail, *Sechehaye* could understand that the green apples directly from the tree represented mother's milk directly from mother's breast, and that this was the only food Renée wanted to have and dared to take. Consequently *Sechehaye* would give pieces of apple to Renée telling her that she, mother, was giving her milk from her breast; and Renée would press the piece of apple against *Sechehaye's* breast and eat it happily. By proceeding from one kind of food to another, following the schedule of a child being weaned, the patient was brought back to normal eating habits. If Renée would identify with a doll in a loving way, *Sechehaye* would treat this doll in the same loving way so as to satisfy its needs in terms of Renée's own regressive wishes. When Renée was furiously and desperately jealous of other patients, *Sechehaye* would manufacture paper dolls and join the patient in treating these dolls in a cruel and despising way. When phallic material emerged, *Sechehaye* would relish being sprinkled by the patient with an Eau de Cologne spray. All the time *Sechehaye* gave the patient enormous amounts of love and care, time, acceptance and reas-

surance in words, gestures, and acts. After several years of this intensive treatment the patient made a complete recovery.

Without having to repeat what has been said before, it can be understood, at least partly, how in this way the therapist would serve as a bridge to reality for the patient. However, we have to realize that our explanations are only attempts at formulations to help us understand what is actually taking place; and, most likely, they are simplified and incomplete ones.

We have been discussing the rôle which the emotional approach, interpretations of dynamics and genetics and interpretations of content all play in therapy. The picture of the applications of these agents has been kaleidoscopic. One factor, however, emerges with clarity: the personality of the therapist is of great importance as regards both the choice of procedure and the success which will ensue. It is particularly obvious that techniques like *Rosen's* and *Sechehaye's* cannot be used by everybody, regardless of intelligence, knowledge, training, and emotional stability. This kind of work requires a devotion to the task beyond the limit which can ordinarily be gained by otherwise reasonably interested and conscientious therapists, also analytical ones. Strictly personal qualities must be considered relevant. *Eissler* (5) writes a good deal about it. There are, he says, people who, without saying or doing much, by virtue of their mere appearance, create an effect on others which reaches beyond what they directly do or say, an effect which is close to fascination. These are the persons, he states, who possess the particular gift for treating schizophrenics, in contradistinction to those who have to rely on the content of their verbalizations. The latter kind of therapist will have a much harder time with these patients.

Be this as it may, one thing is certain: the therapist must possess a reasonably high degree of emotional stability, self reliance, and personal security. *Knight* (15), *Fromm-Reichmann* (9, 10, 11, 12, 13) and *Eissler* (4, 5) all emphasize this in elaborate discussions. In practice it means that the therapist must be well analyzed. He must not be more than realistically afraid of the often very dangerous patients and he must be reasonably well guarded against the anxiety liable to be aroused in him by the patient's anxieties. That is, when anxiety is aroused in him he must be able to check, control, and resolve it. If this is the case, the therapist's own anxiety reactions may be of invaluable help to him in his therapeutic work, helping him to spot the patient's anxieties. Such anxiety reactions, however, also cause therapy of schizophrenics to be taxing on the therapist, much more so than the treatment of neurotics.

The question of the prognosis of psychotherapy with different types of schizophrenia is still an open one. *Brody* (3), in quoting *Bellak* and *Hinsie*, points to a prognostically favorable syndrome established by investigation of patients showing spontaneous remissions: relatively acute onset of illness, the presence of anxiety, short duration of illness before hospitalization, some cyclothymic personality features, an easily delineated psychodynamic problem, an identifiable precipitating situation, and occasionally the presence of some sensorial confusion during the first days of the acute episode. I think a great number of such cases may belong to the group which in Danish psychiatry is not being named schizophrenia, but "psychogenic psychoses". But this syndrome has no bearing on *Rosen's* group of successfully treated patients among whom the majority present all kinds of prognostically bad features. The same applies to *Knight's*, *Wexler's* and *Sechehaye's* patients, and also to my own patient.

A further open question concerns the prospect of a final cure in a psychoanalytic sense. Several authors like *Knight*, *Fromm-Reichmann*, *Rosen*, *Sechehaye*, and others speak of cure of their patients. In reviewing their criteria for cure, however, which are mostly concerned with the disappearance of overt symptoms, social readjustment, and absence of relapses, one feels inclined to agree with *Eissler*, who cautions against the acceptance of such criteria as valid. He points out that they allow for the continued existence of all kinds of discrete and more or less hidden symptoms. *Eissler* thinks that a decisive criterion may be that the patient has gained full insight into his past acute episode, meaning that no pathological feature of this episode—delusions, hallucinations—has retained any quality of reality for the patient. I think he is right that few "cured" patients—if any?—would be able to pass this test, although it may require long and close scrutiny to reveal their occult symptoms, often hidden on purpose.

These statements, however, do not challenge the immense value of affecting a social cure in schizophrenics, a stabilization of formerly hospitalized patients in a state of social readjustment without relapse. That this can be accomplished by psychoanalytically founded psychotherapy seems established beyond doubt.

SUMMARY

Proceeding from a case report by *Robert P. Knight* and using the statements of *Bak*, *Eissler*, *Federn*, *Fromm-Reichmann*, *Rosen*, *Sechehaye*, and *Wexler* the following basic principles in the psychotherapy of schizophrenia are discussed:

- (1) The establishment of contact with the patient by affectionate and by aggressive responses on the part of the therapist. A practical and theoretical evaluation of these tools.
- (2) Interpretations of dynamics.
- (3) Interpretations of content.
- (4) The personal qualifications of the therapist.
- (5) The prospect of a final cure.

It is concluded that although the prospect of a final cure in a strict sense is questionable, the possibility of a social readjustment of schizophrenic patients by psychoanalytically founded psychotherapy seems established beyond doubt.

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INDEX

<i>Brattgård, Sven-Olof and Torsten Lindquist: Method of determining the distribution of administered Halogen ions in the central nervous system</i>	413
<i>Brattgård, Sven-Olof and Torsten Lindquist: Differences in effectivity of the blood-brain barrier in different parts of the central nervous system</i>	423
<i>Forssman, Hans: Follow-up study of sixteen children whose mothers were given electric convulsive therapy during gestation . . .</i>	437
<i>Frøshaug, Harald: A social-psychiatric examination of young front-combatants</i>	443
<i>Helderweirt, G.: Sclérose tuberculeuse révélée par un état de mal épileptique au neuvième jour d'une vaccination antivariolique chez un nourrisson</i>	467
<i>Heppner, F.: Meningiomas of the third ventricle in children . . .</i>	471
<i>Maxwell, A. E.: A statistical review of "psychical symptoms in neurosurgical disease"</i>	483
<i>Naidoo, D.: Gemistocytic Astrocytoma: Cytological observations on the rate of hydrolysis of some phosphoric acid esters . . .</i>	499
<i>Vanggaard, Thorkil: A discussion of the basic principles of the psychoanalytically oriented psychotherapy of Schizophrenia . . .</i>	507
<i>Books Received</i>	528

Papers submitted for publication should be sent to Professor ERIK STRÖMGREN, Risskov, Denmark, when dealing mainly with a psychiatric subject, and to KNUD KRABBE, M.D., Kommunehospitalet, Copenhagen, Denmark, when the subject is mainly neurological.

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